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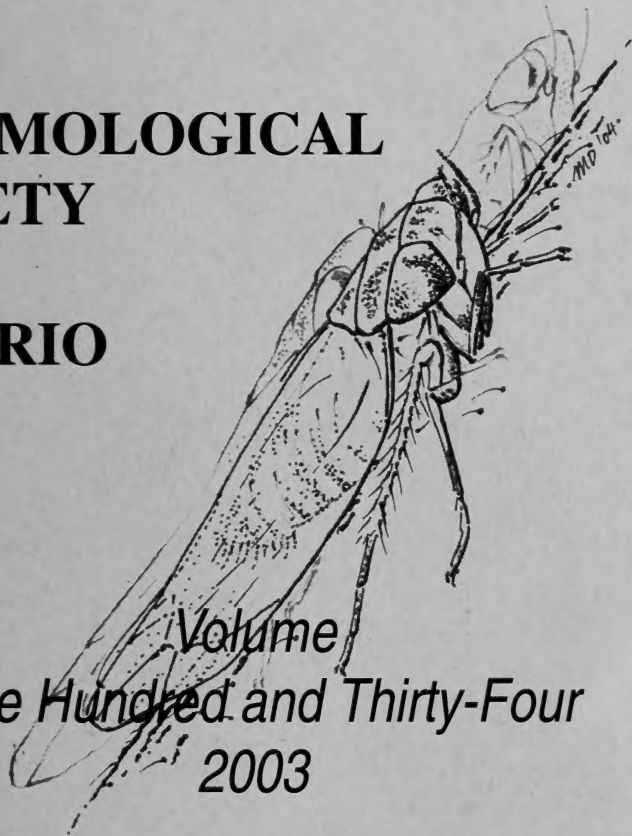
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From the Editor,

This issue contains an invited review article about an entomological issue of current interest to Ontario entomologists. I am pleased to present the concern about the potato leafhopper, *Empoasca fabae* Harris (Homoptera: Cicadellidae), which is an economically significant pest of field legume crops with potential losses of \$250 million per year. The review will also serve as a historical snapshot of changing insect populations in southern Ontario where the potato leafhopper populations have been increasing over the past 15 years. This may be an example of changes in an insect migration due to climate change.

The effort of entomologists in recording changes in the entomofauna of Ontario serves to remind us that even in our own back yards there are many new insect species waiting identification. For example, Buck has uncovered 114 new Ontarian and 53 new Canadian records of spheciform wasps; Romankova reports on seven new Ontarian Colletidae and two new Ontarian Megachilidae; Paeiro et al. report seven new Ontarian and 32 new Canadian Hemiptera and Paiero and Buck report one more species of Megachilidae to Ontario and reports new Canadian and Ontario records for three species of Megachilidae and Andrenidae. In spite of these new species found in Ontario and Canada, Godsoe provides a rare example of evidence that an insect has been extirpated from Ontario, here a pompilid.

Although some insects are encountered often, not much is known about their reproductive habits. This is the case with *Pelecinus polyturator* (Hymenoptera: Pelecinidae) and Bennett's keen eye gives us an insight on its egg-laying habit. And finally Mason et al. provide a second example of a new invasion in Ontario by an insect; this time the cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Marsham) [Coleoptera: Curculionidae] into canola crops.

I thank Martin Damus, our cover artist who took on the challenge of drawing the tiny potato leafhopper. Thanks are again due to K. Jamieson and J.Scott Barsanti for the technical layout of this volume. The review work could only be done with a panel of dedicated associate editors. Volume 135 of JESO is well under way and I am looking forward to reading about your efforts.

Yves Prévost

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BIOLOGY AND MANAGEMENT OF THE POTATO LEAFHOPPER, *EMPOASCA FABAE* (HARRIS) (HOMOPTERA: CICADELLIDAE) ON FIELD CROPS IN ONTARIO

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Abstract*J. ent. Soc. Ont.* 134: 3-17

The potato leafhopper (PLH), *Empoasca fabae* (Harris) (Homoptera: Cicadellidae) is an economically significant pest of field legume crops (Rosales: Leguminosae) such as soybeans, *Glycine max* L., edible beans *Phaseolus vulgaris* L., alfalfa, *Medicago sativa* L., and potato, *Solanum tuberosum* L. (Solanales: Solanaceae) in Ontario, causing potential losses of \$250 million per annum. The PLH is a lacerate-and-flush feeder causing phytotoxicity expressed as hopperburn, resulting in the accumulation of photosynthates above feeding points and reduced rates of photosynthesis, respiration and plant growth. Damage symptoms responsible for yield reductions appear as: distorted leaf veins, yellowing margins and V-shaped wedges of chlorotic tissue, with leaves eventually becoming cupped with necrotic margins. The PLH accomplishes an annual migration, with winters spent in the southernmost regions of the United States, followed by a northward migration to north central and eastern United States and Canada in early spring. Effective monitoring for PLH populations in Ontario crops typically involves sweep net sampling, trifoliate counts and the use of yellow sticky cards. Economic injury levels for the PLH vary with susceptibility of infested crop. Resistant cultivars, trap crops, and seed treatments are discussed as viable alternatives to conventional insecticide applications for PLH control.

Biology**Biology and Development**

The potato leafhopper (PLH), *Empoasca fabae* (Harris) (Homoptera: Cicadellidae), has been a well-known pest of edible beans since its description in 1841 (DeLong 1938). Adult PLH are wedge-shaped and pale green and are distinguished by a row of six white spots across the pronotum. The taxonomy of the PLH was not clear until 1931 when DeLong confirmed the importance of the lateral-process and the dorsal spines in the pygofer of the internal genitalia of the males for distinguishing species belonging to this genus (DeLong 1938; Medler 1957). The white apple leafhopper (WALH), *Typhlocyba pomaria* McAtee (Homoptera: Cicadellidae), is often confused with the PLH due to its size and shape, but it is much lighter in colour and its host range is more limited (Anonymous 2001). Later instars of WALH nymphs also have two rows of dark dots on the dorsal side of the thorax, and more dots appear on the wing pads when they develop. WALH nymphs and adults primarily move in a forward and backward motion when disturbed, whereas PLHs can move sideways as well as forward and backward (Anonymous 2001).

Immatures pass through five nymphal instars which develop by incomplete metamorphosis. Under constant temperature regimes, the PLH requires approximately 301 degree days (C) to develop from egg to adult when reared on broad bean, *Vicia faba* L. (Rosales: Leguminosae) (Simonet and

Pienkowski 1980). Adult females normally mate within 48 hours of emergence. The preoviposition period under field conditions is from 3-5 days (DeLong 1938).

Females insert eggs directly into the larger veins and petioles of host plant leaves at a rate of about 4 eggs per day when temperatures are greater than 10°C (Fenton and Hartzell 1923; Poos 1932; Sher and Shields 1991). A female has the potential to produce 124 eggs, given that the average longevity of adults is 35 days; females live slightly longer than males (Poos 1932). PLH eggs are difficult to see unless the plant tissue is cleared using lactophenol (Carlson and Hibbs 1962). Eggs hatch within 7-10 days in continuously high summer temperatures, but the incubation period can extend to 23 days during cooler periods (DeLong 1938). Fecundity is 37% lower for PLH reared on alfalfa vs. edible beans (Kieckhefer and Medler 1966). The net reproductive rate, intrinsic rate of increase, oviposition period and population growth rate of PLHs are further reduced on water stressed alfalfa plants, with males slightly more affected than females (Hoffman et al. 1991; Hoffman and Hogg 1991).

Eclosion is related to temperature, with nymphs emerging later in the day during cooler periods (Poos 1932). Initially, the head of the emerging nymph is pushed through the plant epidermis. After an extended period of time, the neonate with conspicuous red eyes emerges until only the tip of the abdomen remains within the plant tissue. With its dorsal side downward, the nymph rapidly liberates and exercises its legs with which it grips the leaf vein and then pries the remaining portion of the abdomen from the leaf tissue. Nymphs begin feeding on the under surface of leaves immediately and complete the development from egg hatch to adult in about 15 days at temperatures between 15-20°C (Poos 1932).

The developmental times of eggs and nymphs, as well as overall longevity, decrease as mean temperatures increase (Sher and Shields 1991). Cold hardiness tends to increase as PLHs develop from egg through adult (Specker et al. 1990). When spring temperatures drop below 5°C, nymphs may drop into soil cracks where temperatures are slightly warmer than ambient (Shields and Sher 1992). As the proportion of individuals in soil crevices increases with decreasing temperature this behaviour has been categorized as a strategic response to unfavourable conditions in northern breeding grounds (Shields and Sher 1992). In Ontario there are three to four generations during the summer months.

Distribution and Host Range

The PLH overwinters predominantly in the southernmost portions of the United States. In the Gulf states, PLH reproduces on castor bean and other wild host plants during the winter, where populations increase before migration into north central and eastern United States and Canada in the spring (DeLong 1938; Pienkowski and Medler 1964). Physical and climactic factors, particularly elevation, relative humidity and rainfall, are responsible for the PLH's eastern distribution. DeLong reported that the PLH is of economic importance in eastern regions that are below 950 m in elevation with an average relative humidity of 40-60% (DeLong 1938). For PLHs to reach economically significant populations, high temperature must be combined with normal humidity and precipitation (DeLong 1938). However, monitoring of weather patterns over the past 15 years in Ontario has demonstrated that PLHs are becoming more abundant, causing an increase in damage under hot, dry conditions.

The PLH has been identified on over 200 host plants. In the south, trees such as hickory, oak and southeastern pines are typically a source of reinfestation for seasonal crops (Poos 1935; Taylor 1995). Alfalfa is usually the crop first infested after arrival of PLHs in Ontario. In late May, potatoes and beans become infested with adults dispersing from alfalfa by means of low-level flight. Following each alfalfa harvest, adult PLHs return to feed on the succulent regrowth.

Migration and Dispersal

Warm south winds and air masses moving north up the Mississippi Valley trigger a northward migration each spring, resulting in the infestation of many important crops in north central and eastern United States and Canada. Pienkowski and Medler (1964) suggested that a low-pressure trough in conjunction with a low-level jet stream on the face of a cold front is required for long-distance transport of PLHs.

The PLH accomplishes an annual migration, with its autumn return to the overwintering area in reproductive diapause assisted by the movement of the fall weather systems, particularly low pressure fronts with calm winds or winds with a southerly flow (Shields and Testa 1999). For long distance migration, the PLH must either fly or be carried to altitudes as high as 1220 m (Medler 1957; Pienkowski and Medler 1964; Shields and Testa 1999). At this altitude, PLH may be transported approximately 30% faster than individuals at 300 m above ground level (Pienkowski and Medler 1964). Temperature fluctuations impose limits upon the transport of PLHs in upper air currents. When the surrounding atmospheric temperature drops below 12°C, the flight termination threshold, PLHs fold their wings and descend until temperatures above 12°C are encountered (Taylor and Reling 1986). The activity period leading to flight into the planetary boundary layer (the part of the troposphere extending upward from the earth's surface to 100 to 3000m where long-range transport occurs) begins about one hour before sunset and ends 30 minutes after sunset. In one study, PLH reached peak densities at 152 m, 20 minutes after sunset (Shields and Testa 1999). Migratory flight appears to be correlated with declining barometric pressure 12 hours prior to the normal evening activity period, which occurs around sunset (Shields and Testa 1999). Migratory PLHs are precipitated out of the air by downdrafts, exhaustion, termination of flight, precipitation with rain or cooling.

Depending on location, collections in late spring in northern breeding grounds are predominantly females (Medler 1957). When conditions for migration are favourable, PLHs may be detected on alfalfa in Ontario as soon as early May. After females have reached northern breeding areas, short distance dispersal occurs throughout fields of preferred crops. Approximately 90% of all flight activity associated with short-distance dispersal occurs during the dark hours (Medler 1957). The majority of this movement takes place before midnight, with a peak 30 minutes after sunset; often this is a calm period with particularly low wind velocity (Dysart 1962). Precipitation triggers an increase in short distance dispersal due to the impact of falling raindrops (Dysart 1962).

Host Selection and Preferences

The PLH has several preferred hosts. Leguminous hosts are preferred, followed by potatoes and other species of *Solanum*. Common bean seedlings have a much higher sugar content than emerging potato plants, perhaps explaining why the potato plants do not attract the PLH until the plants have reached a considerable size and maximum sugar content (DeLong 1938). As the PLH feeds, sucrose increases in infested plants, making the plant attractive for continued feeding (Hibbs et al. 1964). PLHs also demonstrate variable settling behaviour. On alfalfa, stems are preferred over leaves. Contrastingly, on broad bean, fewer PLHs are found on stems while the use of abaxial leaf surfaces corresponds with availability (Backus et al. 1990). The preference for the abaxial surface of leaves compared to the upper surface may be attributed to higher transpiration rates, and consequently higher humidity on the undersides of leaves (DeLong 1938).

Many factors affect the frequency and intensity of PLH infestations. Favourable weather conditions are important for the build-up of heavy populations of this pest (Poos and Wheeler 1943). The stage of development, condition, abundance and continuity and the inherent characteristics of preferred host plants at the time of infestation can dramatically affect the rate of PLH oviposition and nymphal development (Poos and Wheeler 1943). The developmental stage

of the host also affects selection behaviour, as younger, more succulent tissue is favoured (Poos and Wheeler 1943).

Although it is difficult to precisely determine what attracts PLHs to host plants, preliminary evidence suggests that preferred varieties of edible beans are selected on the basis of visual properties rather than olfactory cues (Bullas et al. unpublished). Lime green, spring green and yellow sticky card traps attract the highest numbers of adults in free-choice tests (Chu et al. 2000). These hues have relatively low reflectance values in the blue region of the spectrum (400-460 nm) and moderately high reflectance in the green, yellow, and orange spectral regions (490-600 nm), characteristic of the abaxial surfaces of many leguminous leaves (Chu et al. 2000). PLHs are least attracted to colour card traps with low reflectance values at all wavelengths, such as black and dark green, and those with moderately high reflectance in the blue and red regions of the spectrum (Chu et al. 2000). Sampling of numerous potential native and exotic cultivated and natural hosts indicates that PLHs prefer species belonging to the family Fabaceae, with 61.8% of the host species represented by this family (Lamp et al. 1994).

Feeding Habits and Damage

In alfalfa and other preferred crops, the injection of copious amounts of watery, digestive saliva into the plant and the mechanical damage that occurs during laceration result in the deformation and blockage of sieve elements (Backus and Hunter 1989). Photosynthate accumulates above the blockage and causes phytotoxicity (Backus and Hunter 1989).

Early investigators believed that the PLH was strictly a phloem-feeding pest (Hunter and Backus 1989). However, the occurrence of dark green material in the gut, visible through the transparent abdominal cuticle resulting from the consumption of significant quantities of non-translocated, membrane-bound plant pigments such as chlorophyll, supports the hypothesis that PLHs ingest from the mesophyll as well as the phloem (Hunter and Backus 1989). Feeding behaviour may vary on different host plant species (Backus and Hunter 1989). For example, the PLH is classified as a lacerate-and-flush feeder that preferentially ingests from mesophyll tissue on broad beans and from phloem tissue on alfalfa (Hunter and Backus 1989). When the size of plant cells changes in response to environmental stress factors, probing behaviour by the PLH is modified. Water deficiency in alfalfa results in a shift from multiple-cell laceration to phloem ingestion, which is less likely to induce hopperburn than the probing behaviour typically associated with optimal moisture levels (Al-Dawood et al. 1996).

When stylets are damaged during feeding or probing and sheath saliva is deposited in the phloem, cells may collapse and the xylem tissue may be reduced in size, quantity and total cross-sectional area of mature tracheary elements. Ultimately, this may be expressed as leaf curl and eventually as necrosis (Ecale and Backus 1995). Other wound responses to PLH-induced injury include: cell wall loosening and collapse; organelle degradation and cell necrosis; increased mitotic activity in surviving cells; enlargement of nuclei and nucleoli; thickening of secondary cell walls; formation of wound phloem; transfer cell generation; and, premature formation of starch granules in cortical parenchyma chloroplasts (Zhou and Backus 1999). An increase in carbohydrates in damaged tissues suggests a feedback mechanism that enhances the nutritional suitability of the host, subsequently improving plants as hosts for the development of immatures (Granovsky 1930; Hibbs et al. 1964).

The extent of disruption of the translocation process depends upon the developmental stage of the host and the pest. For example, late instar nymphs or adult females appear to cause more damage than early instar nymphs or adult males (Zaky 1981, Flinn et al. 1990). In alfalfa, feeding by fourth instar nymphs significantly reduces the amount of photoassimilate transported to injured tissues, whereas feeding by adults or first instars leads to greater concentrations of assimilate in

the stem below feeding sites (Nielsen et al. 1999). Young vegetative alfalfa plants show reduced translocation rates to shoots, tips and crowns, while translocation is reduced to the crown only in late vegetative plants. A reduction in the basal translocation of photoassimilates induced by lacerate-and-flush feeders may reduce carbon storage and mobilization, nitrogen fixation and winter survival (Lamp et al. 2001). In one study, photosynthate transport to tips of exposed alfalfa stems was reduced up to 62% when compared to plants not exposed to PLH feeding (Nielsen et al. 1990). In contrast, translocation in reproductive plants was not affected by PLH injury (Nielsen et al. 1999). Although infested alfalfa requires more time to reach first bloom, injured plants can ultimately compensate for reductions in nutrient yield associated with later bloom. Therefore harvest based on occurrence of first bloom is preferred to minimize losses in digestible energy (Hutchins and Pedigo 1990).

Disruption of physiological processes in the plant severely affects regrowth rates and survival of alfalfa stands (Lamp et al. 2001). The consequences of intense feeding late in the growth cycle should be considered when pest management initiatives are considered, to ensure persistence of stands over time rather than primarily focusing on the growth of the current crop (Lamp et al. 2001). Transport processes are dramatically affected by PLH feeding during the early stages of plant development when pest management decisions can prevent yield losses. Although the time of arrival of PLHs is not related to the severity of damage, the frequency and number of arriving PLHs, weather conditions during the growing season and crop management all contribute to the ultimate extent of damage experienced by infested crops (Maredia et al. 1998).

Symptoms of Damage

Hopperburn, the disease-like condition induced by PLH feeding, results in reduced rates of photosynthesis, respiration, and plant growth, causing considerable yield losses. The initiation of hopperburn is associated with a cascade of biochemical and physiological changes in vascular tissues that persist for 4 to 8 days (Al-Dawood et al. 1996). This cascade begins with the enhancement of natural wound responses to the injection of saliva, followed by various forms of healing (Al-Dawood et al. 1996). Hopperburn is characterized by distortion of leaf veins and a consequent yellowing of the tissue around the margin and at the tip of the leaf. Symptoms in alfalfa commence as V-shaped wedges of chlorotic tissue radiating from the midpoint of the midrib to the tip of the leaflet (Nielsen et al. 1990). With continued feeding, there is cupping of the margins as the leaf turns from yellow to brown and becomes dry and brittle (DeLong 1940). A central area along the midrib, especially at the base near the petiole, is the last portion of the leaf to change colour. Dwarfing may occur in leaves, stems and/or petioles, and floral development may be reduced or arrested in affected plants.

The expression of hopperburn varies slightly between hosts. In alfalfa, this damage is known as "leafhopper yellowing" although it may appear in shades of pink, red and purple as well as yellow (Poos and Wheeler 1943). Damaged alfalfa plants are stunted and less vigorous and tend to show less regrowth following cutting, lower protein levels, and increased winter mortality. Because leaves contain the majority of digestible protein found in alfalfa plants, damage may result in crude protein loss as high as 28.6% (Hower and Flinn 1986). Most damage to alfalfa occurs after infestations of the second and third cuttings, as early season populations rarely reach damaging numbers unless the first cutting is delayed.

On peanut, the disease-like injury inflicted by PLHs is referred to as "pouts" and is first expressed by burning of the tips and margins of the leaves; then progresses to yellowing and dwarfing of the foliage (Poos and Wheeler 1943).

Hopperburn in edible beans is expressed as yellowing and downward curling of leaves, followed by necrosis, stunted growth, reduced pod number, reduced number of seeds per pod, and reduced

seed weight when infestations are severe (Schoonhoven et al. 1978). The severity of damage is correlated with yield reductions in unprotected plots of susceptible cultivars (Lindgren and Coyne 1994).

Management

Economic Importance

The PLH is a serious pest of many agricultural crops in Ontario, particularly edible bean, potato, alfalfa, peanut *Arachis hypogaeae* L. (Rosales: Leguminosae) and soybean. Traditionally, PLHs could be expected sporadically in hot, dry seasons in the more southern regions of Ontario such as the counties of Kent and Essex and the Regional Municipality of Niagara. With the increased occurrence of hot, dry summers, the frequency of economic infestations of PLHs have increased in the last 15 years, and more frequent damage is now seen in Middlesex, Huron and Perth Counties to the north and east of the traditional area.

In 2001, approximately 61,650 ha of edible beans, 17,320 ha of potatoes, 853,900 ha of alfalfa, and 900,400 ha of soybeans were grown in Ontario (Anonymous 2001). Although some peanuts are grown in Ontario, the total area is considered insignificant, and their contribution to the agricultural economy is low. While soybean is a major cash crop in Ontario, economic losses are rare because PLHs are mainly repelled by dense leaf pubescence (Elden and Lambert 1992).

The damage inflicted by the PLH has the potential to reduce yields by 20-30% in alfalfa and potatoes and as much as 60% in edible beans; this corresponds to potential losses of a quarter of a billion dollars in Ontario per annum. With a total annual farm gate value of \$60,000,000 (Anonymous 2001), the potential loss for edible beans is \$12,000,000 without considering the value-added costs further down the food supply chain. In 2001, potatoes and alfalfa had total farm gate values of \$87,444,000 and \$305,900,000 respectively. This translates to potential losses of about \$52,470,000 for potato and \$183,540,000 for alfalfa.

Losses in alfalfa are currently underestimated by producers (Peter Johnson OMAF extension specialist, pers. communication), especially in the northern counties where growers are unaccustomed to scouting for PLHs. The majority of economic losses in forage legumes are linked to reductions in biomass associated with shorter stems (Lefko et al. 2000a).

The cost of protection against the PLH varies amongst crops. In edible beans, most growers apply dimethoate from one to four times per season. Based on the average production figures and estimates of treated areas, and at a cost of about \$36 per ha including application and insecticide costs, growers spend close to \$2.25 million annually for each insecticide treatment. It is more difficult to calculate the cost of control in potatoes, because PLH protection is often secondary to protection from other insects such as aphids or the Colorado potato beetle, *Leptinotarsa decemlineata* (Say) (Coleoptera: Chrysomelidae). Ten years ago, 10% of the alfalfa producers in the Niagara region sprayed once per season for PLH. More recently, about 50% of these producers applied at least one insecticide per season for PLH and 10 % applied an insecticide as required by monitoring thresholds after every harvest (Winnicki, Clark AgriService, pers. communication). While PLH-resistant alfalfa cultivars have recently been introduced, currently less than 5% of the new seedlings comprise resistant cultivars (Welbanks, Pioneer Hi-Bred Canada, pers. communication). Growers within the Niagara region have planted PLH-resistant cultivars at an extra seed cost of about \$25.00/ha, but have found that some insecticide treatments are still required (Winnicki, Clark AgriService, pers. communication).

Monitoring and Action Thresholds

It is difficult to accurately predict the arrival and magnitude of spring PLH populations, and management strategies are usually reactive rather than proactive (Maredia et al. 1998). In some

northern regions, large influxes of adult PLHs arrive without warning and result in major economic losses in regional crops before management of the pest can be implemented (Maredia et al. 1998).

Preventative management strategies for control of the PLH require an understanding of the relationship between weather, pest status and arrival times. A variety of techniques have been investigated for sampling the PLH, including sweep netting, pan traps, *in situ* counts, D-vac sampling, and the use of other traps, but few techniques are adequate for preventative management decisions (DeGooyer et al. 1998). Delong (1940) stated that although counting the entire catch obtained by 100 full sweeps of a standard sweep net provided an index of species present, the results obtained by this method were highly variable and of limited value. However, in spite of the questionable precision of this technique, alfalfa is commonly monitored in early July or after the first cutting by taking 20 sweeps in five representative areas of the field. Crop height in each sampled area is also considered. As the height of alfalfa increases, the number of PLHs necessary to cause economic damage also increases. For example, economic thresholds for PLHs are 0.2 adults/net sweep, 0.5 adults/net sweep, 1.0 adult or nymph/sweep net and 2.0 adults or nymphs/sweep net for stem heights of 7.5 cm, 15 cm, 20-25 cm and 30-35 cm respectively (Wilson 1981). Sampling should be performed on warm, calm days.

Yellow sticky traps oriented horizontally and level with the top of the canopy can provide effective relative estimates of PLH densities in alfalfa (DeGooyer et al. 1998). However, higher accuracy is obtained from counts of nymphs per 25 or 50 trifoliate leaves randomly selected from a plot. Nymphs are preferred for monitoring because adults are highly mobile and move among plants, rows and fields within a particular area, and eggs are not visible unless leaf tissue has been cleared.

Monitoring for adults in potatoes involves 10 random sweep net samples, with management decisions based on a treatment threshold of 5 to 10 PLHs per sweep (Whalen 2000). Nominal thresholds in beans are based on the number of nymphs per leaf with consideration of the stage of plant development. In Ontario, treatment is recommended when an average of 0.25 nymphs per leaf are detected at the unifoliate stage or 0.5, 1.0, or 2.0 nymphs at second trifoliate, fourth trifoliate and first bloom, respectively (Anonymous 2002a). Sweep nets to sample adults in edible beans are not recommended under humid conditions because of the high risk of spreading bacterial disease.

Economic Injury Levels

Economic injury levels (EIL) for the PLH are commonly expressed as the number of injury equivalents per production unit. The EIL is equivalent to the cost of management per production unit divided by the market value per production unit, multiplied by the yield loss per insect and the proportionate reduction of the insect population (Ogunlana and Pedigo 1974; Hunt et al. 2000). Due to varying levels of resistance or susceptibility, the EIL for the PLH varies with the infested crop and variety. PLH resistance creates a significant yield advantage, warranting the calculation of separate EILs for susceptible and resistant cultivars (Lefko et al. 2000a). The absence of well-defined EILs for PLHs has led to the prophylactic application of insecticides (Ogunlana and Pedigo 1974). The EIL is dynamic and must be adjusted according to current market values and environmental conditions (Ogunlana and Pedigo 1974). Considering these factors, Ogunlana and Pedigo (1974) calculated a gain threshold for PLHs in soybeans for aerial application of malathion at the rate of 100 kg/ha. This gain threshold translated into an EIL, which ranged from 1 PLH/2 trifoliates to 18 PLH/2 trifoliates at the R7 stage of development when beans are beginning to form.

Seedling soybeans are most at risk when late planting is followed by a large migration of PLHs (Hunt et al. 2000). Seedling soybean leaves (VC through V4) are primarily composed of young, expanding tissue with softer, less abundant pubescence and consequently are more susceptible

to PLHs than older, hardened-off leaves (Hunt et al. 2000). Therefore, the EIL for soybeans increases with plant maturity, and ranges from 1.4-3.6 PLH/plant at the V1 stage (2 trifoliate leaves) to 6.5-16.7 PLH/plant at V4 (Hunt et al. 2000). Onstad et al. (1984) described a similar relationship for alfalfa in a model which incorporated pest density, infestation period, weather, crop condition and the management tactic selected.

Natural Enemies

Due to its capacity to rapidly attain damaging populations and move freely, the PLH is not a suitable candidate for biological control initiatives. Preliminary trials showed that chrysopids and coccinellids, both natural predators of the PLH, consumed only 23 and 10 nymphs, respectively, over a five-day period (Fenton and Hartzell 1923). Despite the fact that up to 40% of PLH eggs are effectively parasitized by the small hymenopteran *Anagrus armatus* (Ashmead) (Hymenoptera: Mymaridae), this parasitoid was unable to maintain sufficient control under field conditions (McGuire unpublished).

Zoophthora radicans (Brefeld) Batko (Zygomycetes: Entomophthorales) (synonym: *Erynia radicans* (Brefeld)), a fungus, causes natural epizootics in PLH populations under a narrow environmental regime (Magalhaes et al. 1991). The formation of appressoria, the infectious structure of this fungus, depends upon temperatures between 25° and 30°C, the presence of nitrogen and carbon sources in specific concentrations, and a specific volume of water covering the conidia prior to germination (Magalhaes et al. 1991). Since such precise requirements are not often experienced under Ontario growing conditions, *Z. radicans* is not currently viewed as a reliable control agent for this province.

Insecticides

Insecticides are the primary means of control for the PLH. Bordeaux mixture, a stomach poison, was the first effective insecticide used to control PLH infestations in potatoes (Fenton and Hartzell 1923). Once adults were detected, a calendar-spray program was initiated with applications at 10-day to two-week intervals. Later, pyrethrum extracts applied to PLHs on bean plants killed all individuals within a few hours, but had no impact on hatching nymphs or eggs (DeLong 1940).

In the 1970s granular formulations of disulfoton, carbofuran and phorate were applied to control PLHs in white beans (Judge et al. 1970). In recent years, organophosphorus insecticides such as dimethoate and phorate and some pyrethroids have been widely used for PLH control. Current recommendations for edible beans in Ontario involve the banded application of phorate applied at planting and/or foliar application of dimethoate when population estimates exceed thresholds (Anonymous 2001). Chloronicotinyl insecticides such as imidichloprid, clothianidin and thiamethoxam applied as a seed treatment have shown some promise for control of PLHs in edible beans (Gillard et al. unpublished). This new class of chemistry is favoured because of its novel mode of action, systemic properties and low environmental risk.

Producers rely mainly on foliar insecticides to control PLHs in alfalfa. Control initiatives must be implemented before symptoms are recognized because plants do not recover well once the transport system of the plant has been disrupted. Therefore applications should be made in strict accordance with damage thresholds. While the application of methoxychlor can substantially increase alfalfa yields when PLH pressure is high, there is considerable regulatory pressure to end the use of chlorinated hydrocarbons (Davis and Fick 1995). Currently, in Ontario, foliar applications of dimethoate, azinphos-methyl or cyhalothrin-lambda are recommended. While cyhalothrin-lambda is preferred from a user and environmental safety viewpoint, the organophosphorus insecticides are more cost effective.

PLHs on potatoes in Ontario are usually controlled secondarily to other major pests such as Colorado potato beetle or aphids (Anonymous 2004). Many of the potatoes in Ontario are treated with in-furrow granular imidacloprid to control Colorado potato beetle. Due to its systemic properties, this application of imidacloprid provides extended protection against PLHs. There are a number of foliar insecticides from several classes of pesticide chemistry that may be used if PLH problems continue throughout the season (Anonymous 2002b).

Host Plant Resistance

Resistant crop lines are feasible alternatives to chemical control practices, and have limited input costs and environmental concerns (Murray et al. 2001). Three main types of resistance all affect PLH host selection. Antibiosis is a direct form of resistance that is detrimental to the pest, causes reduced fecundity, and induces morphological defects or mortality. Antixenosis is circuitous, insects are repelled, and this is ultimately expressed as non-preference for a particular variety (Painter 1951; Kogan and Ortman 1978). Tolerance may be defined as the ability of a plant to support a pest population without sustaining damage that would compromise a susceptible plant (Painter 1951; Lefko et al. 2000b).

Cultivars of edible beans, *Phaseolus vulgaris* (Rosales: Leguminosae) differ in their resistance to the PLH. The inheritance of resistance factors in *P. vulgaris* is polygenic and is increased by recurrent selection (Cardona and Kornegay 1999). Breeding programs have successfully increased tolerance to PLH feeding damage, which has been incorporated into a number of bean market types (Cardona and Kornegay 1999). In Ontario, several small white-seeded experimental lines appear promising, combining resistance to PLHs, high yields, and good canning qualities (Cardona and Kornegay 1999). Non-volatile surface compounds often prevent or alter feeding behaviour by means of antixenotic and antibiotic resistance, while physiological tolerance mechanisms reduce the response of the host to feeding (Shockley and Backus 2002).

White beans might be classed as an intermediately susceptible market class to PLH because insect survival is not affected but reproduction is impeded (Ghosh et al. 1968). In another study conducted by Ghosh et al. (1968), PLHs reared on red kidney beans had an initial mortality rate of 50% rising to 100% by the second week of exposure, suggesting that this variety showed signs of antibiosis, perhaps due to unique plant lectins. A lethal protein called phytohemagglutinin (PHA) is produced as a defence mechanism by some species of Fabaceae (Habibi et al. 1993). When ingested, this compound rapidly kills PLHs. This defence mechanism appears promising for manipulation via DNA recombinant technology to achieve resistance in susceptible host plants (Habibi et al. 1993).

In summary, edible bean lines with low hopperburn scores associated with low nymphal populations may express antixenosis, whereas lines with high nymphal populations and low hopperburn scores, may predominantly be physiologically tolerant to PLHs (Kornegay et al. 1986; Schaafsma et al. 1998).

Most authors report that trichome morphology and density on edible beans do not play a major role in tolerance to PLHs (Schaafsma et al. 1998; Shockley and Backus 2002; Ranger and Hower 2001). Blends of volatile compounds, particularly viscous trichome exudates, are more likely to contribute to PLH resistance in alfalfa (Ranger and Hower 2001). The normal dense pubescence commonly found in most soybean cultivars provide a high level of resistance to the PLH, and significantly reduce feeding damage and oviposition and have increased adult mortality, in contrast to glabrous varieties which are much more susceptible to damage (Ogunlana and Pedigo 1974; Elden and Lambert 1992).

Traditional field-screening has been used by alfalfa breeding companies to select genotypes that appear resistant to hopperburn (Shockley and Backus 2002). Because mechanisms of resistance

are chemically and physically based, adult PLHs may be repelled or not attracted by volatiles, while glandular hairs may impede development of nymphs (Ranger and Hower 2001). Genotype G98A has been identified as the most repellent and consequently the most resistant variety of alfalfa, in contrast to Ranger, the least repellent and most susceptible alfalfa cultivar (Shockley et al. 2002). Trichomes on glandular-haired varieties of alfalfa are the source for the physio-chemical defensive parameter that makes G98A and 1-27-1 resistant (Shockley et al. 2002). More PLH mortality is observed on these genotypes than on all others (Shockley et al. 2002). Less feeding damage and lower nymphal populations were observed on the alfalfa germplasm B16-PLH, which has highly pubescent stems and is desirable due to its height, rapid growth, and winter hardiness when compared with Ranger and other susceptible varieties (Elden and Elgin 1989). The effects of trichomes and PLH resistance are indirectly linked to hopperburn resistance which involves additional resistance factors (Shockley et al. 2002). Alfalfa that is resistant to the PLH produces more dry matter than susceptible genotypes, due to more nodes, longer internodes, longer stems and less hopperburn. These genotypes therefore can maintain more leaves, which leads to higher total crop yield and forage value (Lefko et al. 2000a). AmeriGuard 301, Trailblazer, 5347LH and the experimental line XAE49, are tolerant alfalfa cultivars that perform better than susceptible cultivars when PLH populations are high (Lefko et al. 2000b). In alfalfa, there appears to be a chemical basis for the marked non-preference or antixenotic mechanism of resistance (Horber et al. 1974). Saponins appear to deter PLHs in alfalfa and appear more toxic at higher concentrations (Horber et al. 1974).

Similar instances of resistance are apparent in potatoes; when PLH populations are high, larger, more succulent varieties show considerably less damage and have higher yields than susceptible cultivars (Fenton and Hartzell 1923). There is a negative correlation between total glycoalkaloid concentrations and nymphal survival, duration of settling, ingestion as well as non-feeding on *Solanum* species (Raman et al. 1979).

Trap-Cropping

The distinct preferences of phytophagous insects for particular varieties or growth stages of host plants may be exploited by modification of crop management practices. Intercropping systems provide diversity of host and nonhost vegetation that results in substantially lower pest populations when compared with monocultures (Brewer and Schmidt 1995). Typical intercrops employ the same proportions of host and non-host vegetation, thereby altering host selection habits and consequently reducing population densities (Miklasiewicz and Hammond 2001). A soybean-wheat cropping system initially contains significantly fewer female PLHs, and consequently a smaller population over the course of the year, relative to a uniform planting of soybean (Miklasiewicz and Hammond 2001). Similar suppression of the PLH occurs when alfalfa is intercropped with grassy weeds, forage grasses or oats (Lamp et al. 1984; Lamp 1991). The adoption of intercropping at the farm level has been low because of the rapid and visible control of pests achieved with insecticide application and the complexities that can be encountered with intercropping systems on a large scale.

Trap-cropping, a special type of intercropping, involves the planting of a crop or variety more attractive to the insect pest along with the less attractive main crop. Trap-cropping is most successful if the two plantings are of the same species, because their harvest times will coincide and the trap variety will contribute to the total yield of the harvest (Brewer and Schmidt 1995). The trap-cropping system is most effective when the trap cultivar is more attractive than the main cultivar during the critical period of pest colonization. When presented with a more favourable substitute, pests tend to move into the trap-crop where they may then be controlled by insecticides or some other means. This management tactic leads to a reduction in insecticide application as the trap variety or crop,

commonly planted as border rows, may constitute less than 20% of the entire crop. Management costs and environmental impact are reduced because it is not necessary to treat the entire field.

The behaviour of the PLH lends itself to trap-cropping in edible beans. Short distance dispersal of this pest is mainly restricted to border rows of adjacent fields, which coincides with the typical orientation of trap plantings. With the distinct varietal preferences exhibited by PLHs, a large proportion of the pest population could potentially be diverted from the main crop into the preferred trap cultivar. Saxena et al. (1988) found significantly higher yields in trap fields of a susceptible cultivar of rice compared with a control field not treated to control Cicadellidae.

Under field conditions, 'Berna Dutch brown' bean is preferred by the PLH over all other varieties grown in Ontario (Wylde 1999). Preliminary work (Bullas et al. unpublished) has suggested that plantings of this variety in combination with chloronicotinyl seed treatments is a promising control strategy. A major concern with the use of Berna Dutch brown bean plants as a trap-crop is its limited market. Growers cannot afford to remove a significant percentage of their acreage from production. For this approach to be successful in edible bean production, a significant profit advantage would be required to offset the opportunity cost of the trap-crop. Trap-cropping is a feasible management practice that may enhance yields while preserving the ecological integrity of the agroecosystem. Problems such as insecticide resistance, pest resurgence, adverse impacts on non-target organisms and secondary outbreaks of pests, commonly associated with the overuse of pesticides, can be reduced with the use of trap-crops.

Conclusions

Potato leafhoppers in Ontario field crops tend to be increasing in incidence and severity due to more frequent hot and dry summers. The potato leafhopper is no longer considered a sporadic pest because infestations are more frequent and regular and require extensive monitoring and treatment. Given that a relatively low number of potato leafhoppers in a crop can result in significant damage, more attention to monitoring is required for early detection. Alternatives to broadcast insecticide applications such as trap-crops, seed treatments and plant resistance are needed and crop producers need to be educated in the adoption of these practices.

References

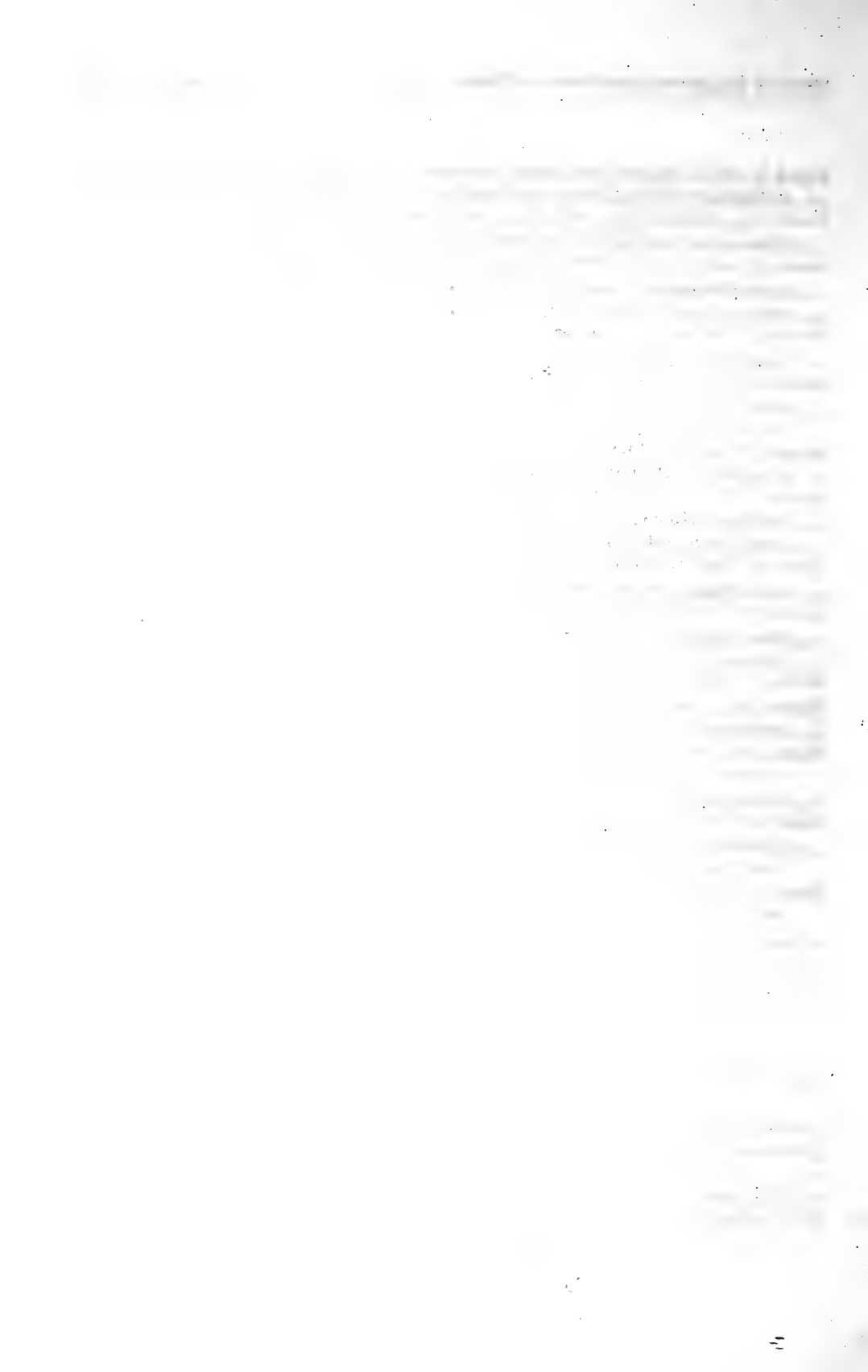
- Al-Dawood, A.S., E.B. Radcliffe, E.A. Backus and W.L. Koukkari. 1996. Probing behaviour of potato leafhopper (Homoptera: Cicadellidae) on alfalfa influenced by plant water deficit. *Journal of Economic Entomology*, 89: 898-905.
- Anonymous, 2001. <http://www.gov.on.ca/OMAFRA/english/crops>
- Anonymous, 2002a. Publication 811: Agronomy Guide for Field Crops. Ontario Ministry of Agriculture and Food. Queen's Printer for Ontario, Toronto. 300 pp.
- Anonymous, 2002b. Publication 812: Field Crop Protection Guide. Ontario Ministry of Agriculture and Food. Queen's Printer for Ontario, Toronto. 77 pp.
- Anonymous, 2004. Publication 363: Vegetable Production Recommendations. Ontario Ministry of Agriculture and Food. Queen's Printer for Ontario, Toronto. 201 pp.
- Backus, E.A. and W.B. Hunter. 1989. Comparison of feeding behaviour of the potato leafhopper *Empoasca fabae* (Homoptera: Cicadellidae) on alfalfa and broad beans. *Environmental Entomology*, 18: 473-480.
- Backus, E.A., N.M. Gruenhagen, and S.A. Becker. 1990. The potato leafhopper (Homoptera: Cicadellidae) exhibits different settling distributions on alfalfa and broad bean. *Journal of Economic Entomology*, 83: 814-818.

- Brewer, G.J. and G. Schmidt. 1995. Trap-cropping to manage the red sunflower seed weevil in oilseed sunflower. *American Journal of Alternative Agriculture*, 10: 184-187.
- Cardona, C. and J. Kornegay. 1999. Bean germplasm resources for insect resistance. pp. 85-90 *In* S.L. Clement and S.S. Quisenberry, Ed., *Global Plant Genetic Resources for Insect-Resistant Crops*, CRC. New York. 295 pp.
- Carlson, O.V. and E.T. Hibbs. 1962. Direct counts of potato leafhopper eggs in *Solanum* leaves. *Annals of the Entomological Society of America*, 56: 512-515.
- Chu, C.C., P.J. Pinter, T.J. Henneberry, K. Umeda, E.T. Natwick, Y.A. Wei, V.R. Reddy, and M. Shrepatis. 2000. Use of cc traps with different trap base colours for silverleaf whiteflies (Homoptera: Aleyrodidae), thrips (Thysanoptera: Thripidae), and leafhoppers (Homoptera: Cicadellidae). *Journal of Economic Entomology*, 93: 1329-1337.
- Davis, P.M. and G.W. Fick. 1995. Potato leafhopper management: effects on egg production and quality of alfalfa-timothy mixtures. *Agronomy Journal*, 87: 795-804.
- DeGooyer, T.A., L.P. Pedigo, and M.E. Rice. 1998. Development of sticky trap sampling techniques for potato leafhopper adults. *Journal of Agricultural Entomology*, 15: 33-37.
- DeLong, D.M. 1938. Biological studies on the leafhopper *Empoasca fabae* as a bean pest. U.S. Department of Agriculture Bulletin, 618. 59 pp.
- DeLong, D.M. 1940. Studies of methods and materials for the control of the leafhopper *Empoasca fabae* as a bean pest. U.S. Department of Agriculture Bulletin, 740. 63 pp.
- Dysart, R.J. 1962. Local movement of potato leafhopper in alfalfa. *Proceedings North Central Branch: E.S.A.*, 17: 100-101.
- Ecale, C.L. and E.A. Backus. 1995. Time course of anatomical changes to stem vascular tissues of alfalfa, *Medicago sativa*, from probing injury by the potato leafhopper, *Empoasca fabae*. *Canadian Journal of Botany*, 73: 288-298.
- Elden, T.C. and J.H. Elgin. 1989. Registration of B16-potato leafhopper alfalfa germplasm resistant to the potato leafhopper. *Crop Science*, 29: 1577-1578.
- Elden, T.C. and L. Lambert. 1992. Mechanisms of potato leafhopper resistance in soybean lines isogenic for pubescence type. *Crop Science*, 85: 1187-1191.
- Fenton, F.A. and A. Hartzell. 1923. Bionomics and control of the potato leafhopper, *Empoasca mali* Baron. Iowa State College of Agriculture Research Bulletin, 78. pp. 380-440.
- Flinn, P.W., A.A. Hower and R.A.J. Taylor. 1990. Immigration, sex ratio, and local movement of the potato leafhopper (Homoptera: Cicadellidae) in a Pennsylvania alfalfa field. *Journal of Economic Entomology*, 83: 1858-1862.
- Ghosh, A.K., J.T. Medler and A.C. Hildebrandt. 1968. Maintenance of *Empoasca fabae* (Homoptera: Cicadellidae) on plants and tissue cultures of three bean varieties. *Journal of the Kansas Entomological Society*, 41: 331-334.
- Granovsky, A.A. 1930. Differentiation of symptoms and effect of leafhopper feeding on histology of alfalfa leaves. *Phytopathology*, 20: 121 (abstr.).
- Habibi, J., E.A. Backus and T.H. Czapla. 1993. Plant lectins affect survival of the potato leafhopper (Homoptera: Cicadellidae). *Journal of Economic Entomology*, 86: 945-951.
- Hibbs, E.T., D.L. Dahlman, and R.L. Rice. 1964. Potato foliage sugar concentrations in relation to infestation by the potato leafhopper, *Empoasca fabae*. *Annals of the Entomological Society of America*, 57: 517-521.
- Hoffman, G.D. and D.B. Hogg. 1991. Potato leafhopper (Homoptera: Cicadellidae) in water-stressed alfalfa: population consequences and field tests. *Environmental Entomology*, 20: 1067-1073.
- Hoffman, G.D., D.B. Hogg and G.M. Boush. 1991. Potato leafhopper (Homoptera: Cicadellidae) life history traits on water-stressed alfalfa in the early regrowth and bud stage. *Environmental Entomology*, 20: 1058-1066.

- Horber, E., K.T. Leath, B. Berrang, V. Marcarian, and C.H. Hanson. 1974. Biological activities of saponin components from DuPuits and Lahontan alfalfa. *Entomologia Experimentalis et Applicata*, 17: 410-424.
- Hower, A.A. and P.W. Flinn. 1986. Effects of feeding by potato leafhopper nymphs (Homoptera: Cicadellidae) on growth and quality of established stand alfalfa. *Journal of Economic Entomology*, 79: 779-784.
- Hunt, T.E., L.G. Higley and L.P. Pedigo. 2000. A re-examination of economic injury levels for potato leafhopper (Homoptera: Cicadellidae) on soybean. *Journal of Entomological Science*, 35: 97-104.
- Hunter, W.B. and E.A. Backus. 1989. Mesophyll-feeding by the potato leafhopper, *Empoasca fabae* (Homoptera: Cicadellidae): results from electronic monitoring and thin-layer chromatography. *Environmental Entomology*, 18: 465-472.
- Hutchins, S.H. and L.P. Pedigo. 1990. Phenological disruption and economic consequence of injury to alfalfa induced by potato leafhopper (Homoptera: Cicadellidae). *Journal of Economic Entomology*, 83: 1587-1594.
- Judge, F.D., F.L. McEwen, and H.B. Rinick. 1970. Field testing candidate insecticides on beans and alfalfa for control of Mexican bean beetle, potato leafhopper, and plant bugs in New York State. *Journal of Economic Entomology*, 63: 58-62.
- Kieckhefer, R.W. and J.T. Medler. 1966. Aggregation of the potato leafhopper in alfalfa fields in Wisconsin. *Annals of the Entomological Society of America*, 59: 180-182.
- Kogan, J.L. and E.F. Ortman. 1978. Antixenosis- a new term proposed to define Painter's "nonpreference" modality of resistance. *Bulletin of the Entomological Society of America*, 24: 175-176.
- Kornegay, J.L., C. Cardona, and A. van Schoonhoven. 1986. The mechanism of resistance in common bean lines to the leafhopper *Empoasca kraemeri*. *Entomologia Experimentalis et Applicata*, 40: 273-279.
- Lamp, W.O. 1991. Reduced *Empoasca fabae* (Homoptera: Cicadellidae) density in oat-alfalfa intercrop systems. *Environmental Entomology*, 20: 118-126.
- Lamp, W.O., M.J. Morris, and E.J. Armbrust. 1984. Suitability of common weed species as host plants for the potato leafhopper, *Empoasca fabae*. *Entomologia Experimentalis et Applicata*, 36: 125-131.
- Lamp, W.O., G.R. Nielsen and S.D. Danielson. 1994. Patterns among host plants of potato leafhopper, *Empoasca fabae* (Homoptera: Cicadellidae). *Journal of the Kansas Entomological Society*, 67: 354-368.
- Lamp, W.O., G.R. Nielsen, B. Quebedeaux and Z. Wang. 2001. Potato leafhopper (Homoptera: Cicadellidae) injury disrupts basal transport of super(14)C-labelled photoassimilates in alfalfa. *Journal of Economic Entomology*, 94: 93-97.
- Lefko, S.A., L.P. Pedigo and M.E. Rice. 2000a. Alfalfa stand tolerance to potato leafhopper and its effect on the economic injury level. *Agronomy Journal*, 92: 726-732.
- Lefko, S.A., L.P. Pedigo, and M.E. Rice. 2000b. Symptoms and growth of potato leafhopper-tolerant alfalfa in response to potato leafhopper feeding. *Agronomy Journal*, 92: 721-725.
- Lindgren, D.T. and D.P. Coyne. 1994. Leafhopper injury on dry edible beans. *Bean Improvement Cooperative*, 37: 71-72.
- Magalhaes, B.P., R.A. Humber, E.J. Shields and D.W. Roberts. 1991. Effects of environment and nutrition on conidium germination and appressorium formation by *Zoophthora radicans* (Zygomycetes: Entomophthorales): A pathogen of the potato leafhopper (Homoptera: Cicadellidae). *Environmental Entomology*, 20: 1460-1468.

- Maredia, K.M., M.E. Whalon, S.H. Gage, and M.J. Kaeb. 1998. Observations of first occurrence and severity of potato leafhopper, *Empoasca fabae* (Harris), (Homoptera: Cicadellidae) in the north central and eastern United States. *The Great Lakes Entomologist*, 31: 73-84.
- Medler, J.T. 1957. Migration of the potato leafhopper: A report on a cooperative study. *Journal of Economic Entomology*, 50: 493-497.
- Miklasiewicz, T.J. and R.B. Hammond. 2001. Density of potato leafhopper (Homoptera: Cicadellidae) in response to soybean-wheat cropping systems. *Environmental Entomology*, 30: 204-214.
- Murray, J.D., T.E. Michaels, K.P. Pauls and A.W. Schaafsma. 2001. Determination of traits associated with leafhopper (*Empoasca fabae* and *Empoasca kraemeri*) resistance and dissection of leafhopper damage symptoms in the common bean (*Phaseolus vulgaris*). *Annals of Applied Biology*, 139: 319-327.
- Nielsen, G.R., W.O. Lamp and G.W. Stutte. 1990. Potato leafhopper (Homoptera: Cicadellidae) feeding disruption of phloem translocation in alfalfa. *Journal of Economic Entomology*, 83: 807-813.
- Nielsen, G.R., C. Fuentes, B. Quebedeaux, Z. Wang and W.O. Lamp. 1999. Alfalfa physiological response to potato leafhopper injury depends on leafhopper and alfalfa developmental stage. *Entomologia Experimentalis et Applicata*, 40: 247-255.
- Ogunlana, M.O., and L.P. Pedigo. 1974. Economic-injury levels of the potato leafhopper on soybeans in Iowa. *Journal of Economic Entomology*, 67: 29-32.
- Onstad, D.W., C.A. Shoemaker, and B.C. Hansen. 1984. Management of potato leafhopper, *Empoasca fabae* (Homoptera: Cicadellidae), on alfalfa with the aid of systems analysis. *Environmental Entomology*, 13: 1046-1058.
- Painter, R.H. 1951. Insect resistance in crop plants. University Press of Kansas, Lawrence. 520 pp.
- Pienkowski, R.L. and J.T. Medler. 1964. Synoptic weather conditions associated with long-range movement of the potato leafhopper, *Empoasca fabae*, in Wisconsin. *Annals of the Entomological Society of America*, 57: 588-591.
- Poos, F.W. 1932. Biology of the potato leafhopper, *Empoasca fabae* (Harris), and some closely related species of *Empoasca*. *Journal of Economic Entomology*, 25: 639-646.
- Poos, F.W. 1935. New host plants of the potato leafhopper, *Empoasca fabae* (Harris), and their probable significance. *Journal of Economic Entomology*, 28: 1072-1073.
- Poos, F.W. and N.H. Wheeler. 1943. Studies on host plants of the leafhoppers of the genus *Empoasca*. U.S. Department of Agriculture Bulletin, 850, 51 pp.
- Raman, K.V., W.M. Tingey, and P. Gregory. 1979. Potato glycoalkaloids: effect on survival and feeding behaviour of the potato leafhopper. *Journal of Economic Entomology*, 72: 337-341.
- Ranger, C.M. and A.A. Hower. 2001. Role of glandular trichomes in resistance of perennial alfalfa to the potato leafhopper (Homoptera: Cicadellidae). *Journal of Economic Entomology*, 94: 950-957.
- Saxena, R.C., H.D. Justo, Jr., and E.L. Palanginan. 1988. Trap crop for *Nephotettix virescens* (Homoptera: Cicadellidae) and tungro management in rice. *Journal of Economic Entomology*, 81: 1485-1488.
- Schaafsma, A.W., C. Cardona, J.L. Kornegay, A.M. Wylde, and T.E. Michaels. 1998. Resistance of common bean lines to PLH (Homoptera: Cicadellidae). *Journal of Economic Entomology*, 91: 981-986.
- Schoonhoven, A.van, L.A. Gomez, and F. Avalos. 1978. The influence of leafhopper (*Empoasca kraemeri*) attack during various bean (*Phaseolus vulgaris*) plant growth stages on seed yield. *Entomologia Experimentalis et Applicata*, 23: 115-120.

- Sher, R.R. and E.J. Shields. 1991. Potato leafhopper (Homoptera: Cicadellidae) oviposition and development under cool fluctuating temperatures. *Environmental Entomology*, 20: 1113-1120.
- Shields, E.J. and R.B. Sher. 1992. Low-temperature survival strategies of potato leafhopper (Homoptera: Cicadellidae). *Environmental Entomology*, 21: 301-306.
- Shields, E.J. and A.M. Testa. 1999. Fall migratory flight initiation of the potato leafhopper, *Empoasca fabae* (Homoptera: Cicadellidae): observations in the lower atmosphere using remote piloted vehicles. *Agricultural and Forest Meteorology*, 97: 317-330.
- Shockley, F.W. and E.A. Backus. 2002. Repellency to the potato leafhopper (Homoptera: Cicadellidae) by erect glandular trichomes on alfalfa. *Environmental Entomology*, 31: 22-29.
- Shockley, F.W., E.A. Backus, M.R. Ellersieck, D.W. Johnson and M. McCaslin. 2002. Glandular-haired alfalfa resistance to potato leafhopper (Homoptera: Cicadellidae) and hopperburn: development of resistance indices. *Journal of Economic Entomology*, 95: 437-447.
- Simonet, D.E. and R.L. Pienkowski. 1980. Temperature effect on development and morphometrics of the potato leafhopper. *Environmental Entomology*, 9: 798-800.
- Specker, D.R., E.J. Shields, D.M. Umbach and S.A. Allan. 1990. Mortality response of potato leafhopper (Homoptera: Cicadellidae) to low temperatures: implications for predicting overwintering and early migrant mortality. *Journal of Economic Entomology*, 83: 1541-1548.
- Taylor, P.S. 1995. Development of migrant source populations of the potato leafhopper (Homoptera: Cicadellidae). *Environmental Entomology*, 24: 1115-1121.
- Taylor, R.A.J. and D. Reling. 1986. Preferred wind direction of long-distance leafhopper (*Empoasca fabae*) migrants and its relevance to the return migration of small insects. *Journal of Animal Ecology*, 55: 1103-1114.
- Whalen, J. 2000. Weekly Crop Update. University of Delaware Cooperative Extension, 8(12).
- Wilson, M.C. 1981. Improving alfalfa forage quality: How to detect and manage the potato leafhopper problem. Certified Alfalfa Seed Council, Inc. 4 pp.
- Wylde, A.M. 1999. A Comparison of Resistance Mechanisms in Common Beans, *Phaseolis vulgaris*, to *Empoasca fabae* and *Empoasca kraemerii*. MSc. Thesis, University of Guelph. Guelph, Ontario. 89 pp.
- Zaky, S.H.F.M. 1981. Damage Potential of Potato Leafhopper Nymphs, *Empoasca fabae* Harris (Homoptera: Cicadellidae) Established on Stand Alfalfa. PhD. Dissertation, The Pennsylvania State University, University Park. 112 pp.
- Zhou, C.L.E. and E.A. Backus. 1999. Phloem injury and repair following potato leafhopper feeding on alfalfa. *Canadian Journal of Botany*, 77: 537-547.



AN ANNOTATED CHECKLIST OF THE SPHECIFORM WASPS OF ONTARIO (HYMENOPTERA: AMPULICIDAE, SPHECIDAE AND CRABRONIDAE)

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Abstract

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A checklist of Ontario spheciform wasps (Ampulicidae, Sphecidae, Crabronidae) is presented based on a comprehensive study of all collections with major holdings of Ontario material, a critical review of previously published records and extensive field work. A total of 278 species is recorded, including 114 new provincial and 53 new Canadian records. The Palearctic species *Pemphredon morio* is recorded for the first time from North America, and seven species, *Passaloecus borealis*, *Tachysphex alpestris*, *Solierella levis*, *Trypoxylon bidentatum*, *T. sculleni*, *Mellinus abdominalis* and *Nysson hesperus* are recorded for the first time from the eastern Nearctic. The distribution of Ontario sphecids is discussed with special emphasis on species with odd distribution patterns and introduced species.

Introduction

The spheciform wasps (Ampulicidae, Sphecidae and Crabronidae, from here on simply referred to as "sphecids") are a group of aculeate Hymenoptera that has attracted much interest because of their complex breeding behaviour. Adults of this group include very small and inconspicuous insects as well as some of the largest and most spectacular wasps of our fauna. Besides their fascinating biology this group is of interest to ecologists and conservation biologists because many of its species inhabit vulnerable and endangered habitats. The taxonomy of most genera is comparatively well known, at least for the eastern Nearctic species. Despite this, the Canadian sphecid fauna has been very poorly studied except for the province of Quebec and the Yukon Territory (Finnamore 1982, 1997).

The present study aims towards narrowing this gap by providing the first annotated checklist of Ontario sphecids, including over a hundred new records for the province. Because most species reach the northern or northeastern limit of their range somewhere within the province, this checklist also provides an important reference for anyone interested in the biogeography of Nearctic sphecids. Furthermore, this work is relevant for the development of national species protection strategies because many Canadian sphecid species (ca. one quarter of the species known from Ontario) occur in no other Canadian province or territory except Ontario. This area is also the most densely populated in the country and some of the species in question are restricted to habitats that are very sensitive to human disturbance.

Up to now only about 165 sphecid species have been reported from Ontario (Krombein 1979, and other authors: see Table I), insignificantly more than the 163 species recorded from Quebec (Provancher 1883, 1885-1889, Finnamore 1982, additions by Dollfuss 1995; misidentifications and doubtful records excluded). Considering the more southern location of Ontario, which includes parts of the Carolinian life zone, one would expect a much higher number of species than in Quebec. In fact, the present work demonstrates that the previously recorded 165 species represent less than 60 % of the total fauna.

The earliest works on the sphecoid fauna of Ontario were published by Provancher (1883, 1885-1889) and Harrington (1902). Harrington (who included all of Provancher's records) reported 73 valid species from the Ottawa region. Despite being published over a century ago, his work remains by far the most extensive previously published paper on Ontario sphecids. Later, Walker (1913) published a list of species from Toronto (26 species) and Brown (1934) studied the fauna of the Temagami [= Timagami] area in northern Ontario (16 species). Fye (1965) reported on the biology of three species of Pemphredoninae. Only recently, further faunistic papers were published: Blades and Marshall (1994) listed 11 species taken in pan traps in south-central Ontario peatlands. Sugar et al. (1998) recorded 39 species from oak savannah habitats in southern Ontario and Skevington et al. (2001) provided a checklist of the species of Lambton County in southwestern Ontario including 28 taxa. In an unpublished report to Parks Canada Marshall et al. (2001) recorded 57 species from Bruce County in southcentral Ontario.

The present paper represents the first checklist on Ontario spheciform wasps. The preparation of this list involved a critical review of all previously published species records, a comprehensive study of all major collections, and four years of field work. The distribution of Ontario sphecids is discussed with emphasis on species with unusual distribution patterns and introduced species.

Materials and Methods

Material examined. The present checklist is based mostly on material in the following five major collections: University of Guelph, Department of Environmental Biology (Guelph); Canadian National Collection of Insects (Ottawa); Laurence Packer collection (York University, Toronto); Royal Ontario Museum (Toronto); and University of Manitoba, Entomology Department (Winnipeg). The study involved a review of Ontario material from these collections including verification of previous determinations and identification of all previously unidentified specimens. In the case of material from the Canadian National Collection previous identifications were only reviewed in their entirety for taxonomically difficult groups, for rare species, and for unpublished Ontario records; otherwise only a few voucher specimens per species were checked. A.V. Antropov (*in litt.*) provided data on some specimens of *Trypoxylon* currently on loan to him from their collection. Occasional records from other collections were included if available (see list of depositories below). F.E. Kurczewski (*in litt.*) kindly provided additional data from his collection, and H.S. Court and W.J. Pulawski (*in litt.*) contributed records from the collection of the California Academy of Sciences. Two records were included based on photographs of live specimens taken in the field by H. Goulet (Canadian National Collection).

Classification and Identification. The nomenclature used in this paper follows almost entirely¹ the "Catalog of Sphecidae sensu lato" which is available on the internet and is constantly updated (Pulawski 2004). Following Melo (1999) the following families and subfamilies of Ontario spheciform wasps are recognised: Ampulicidae, Sphecidae (including only Sphecinae sensu Bohart and Menke 1976), and Crabronidae²: (including subfamilies Pemphredoninae, Astatinae, Crabroninae [incl. Larrinae], Bembicinae and Philanthinae). The systematic arrangement of taxa largely follows Krombein (1979) except where conflicting with modern classification. In a few cases new synonymies and revised species concepts (within *Hoplisoides*, *Nysson* and *Epinysson*) are being used that will be discussed in detail in separate publications (Buck, in prep.). Identifications

¹ The proposed synonymy of *Synnevrus* with *Nysson* is not adopted here because it has never been published formally.

² Melo's controversial placement of the Ammoplanina and Mellinini in the Astatinae and the Crabroninae, respectively, is not adopted here.

for certain species of the following groups were checked by specialists: *Podalonia* (A.S. Menke, Ammophila Research Institute, Arizona), *Tachysphex*, *Tachytes* (W.J. Pulawski, California Academy of Sciences), and the *Trypoxylon figulus*-group (A.V. Antropov, Zoological Museum, Moscow State University). Helen S. Court (California Academy of Sciences) provided crucial help in identifying some species of *Nysson* and *Synnevrus*.

Recording standards for new Ontario records. The current edition of the "Catalog of the Hymenoptera in America North of Mexico" (Krombein 1979) often provides distribution ranges rather than explicit provincial or state records. Therefore the presence or absence of certain species in Ontario is not always clear. In the absence of other explicit literature records the following standard was adopted for interpreting distribution ranges in Krombein (1979): Species with entries in the form of "Canada and U.S. east of 100th meridian", or "transcontinental in Transition and Austral Zones" were considered published Ontario records if the presence of the species was confirmed by specimens in collections. However, species with catalog entries like "Upper and Lower Austral Zones of North America" were treated as unrecorded because the Upper Austral Zone merely touches extreme southwestern Ontario along the shore of Lake Erie, including the Niagara Peninsula (see Scudder 1979, Fig. 3.11).

Recording species distributions within Ontario. The locality records under each species are arranged according to Ontario's primary administrative divisions (Figs 1, 2). Unfortunately, names for these divisions sometimes vary according to the source (e.g., Natural Resources Canada 2004, Ontario Road Atlas 2003). The names adopted here are the ones used by Natural Resources Canada (2004) on their website 'Geographical Names of Canada'. The following administrative divisions have alternative names (names used in Ontario Road Atlas (2003) given in parentheses): Carleton (City of Ottawa), Kent (Municipality of Chatham-Kent), Victoria (City of Kawartha Lakes), Wentworth (City of Hamilton). The following divisions have been amalgamated according to some sources: Toronto and York (Regional Municipality of York), Lincoln and Welland (Regional Municipality of Niagara), Haldimand and Norfolk (Haldimand-Norfolk Region). Formerly Ontario's administrative divisions were either termed 'counties' or 'districts'. Recently many counties have adopted alternative terms like 'regional municipality', 'municipality', 'city' or even 'management unit' (Ontario Road Atlas 2003). For the sake of simplicity only the names proper (excluding all attributes like 'regional municipality', 'county', 'district', etc.) are used in the presentation of data below.

Prey records. Prey records are given in a separate paragraph under each species where available. Females that were collected with prey are indicated by asterisks (*) or superscript numbers (e.g., ¹) in the data paragraph. Most prey items were identified by S.M. Paiero (University of Guelph) (all Hemiptera, Coleoptera, Tettigoniidae, Tridactylidae and Blattaria) except for Acrididae, which were determined by D.L. Johnson (Agriculture Canada, Lethbridge), and some Apoidea and Diptera identified by the author.

Specimen depositories. All material is deposited in the University of Guelph Insect Collection (DEBU) unless indicated otherwise: BAR – private collection of Brad Arnal and Harold Duggan, Waterloo, Ontario; BCPM – Royal British Columbia Museum, Victoria, British Columbia; CASC – California Academy of Sciences, Department of Entomology, San Francisco, California; CNCI – Canadian National Collection of Insects, Ottawa, Ontario; EDUM – J.B. Wallis Museum, Entomology Department, University of Manitoba, Winnipeg, Manitoba; FEK – collection of Frank E. Kurczewski, Syracuse, New York; LEMQ – Lyman Entomological Museum, McDonald College, McGill University, Ste-Anne-de-Bellevue, Quebec; LPC – collection of Laurence Packer, York University, Toronto, Ontario; PMAE – Provincial Museum of Alberta, Edmonton, Alberta; ROME – Royal Ontario Museum, Toronto, Ontario; TAMU – Department of Entomology, Texas A&M University, College Station, Texas; ULQC – University of Laval, Department of Biology, Quebec, Quebec; USNM – United States National Museum, Washington, D.C.

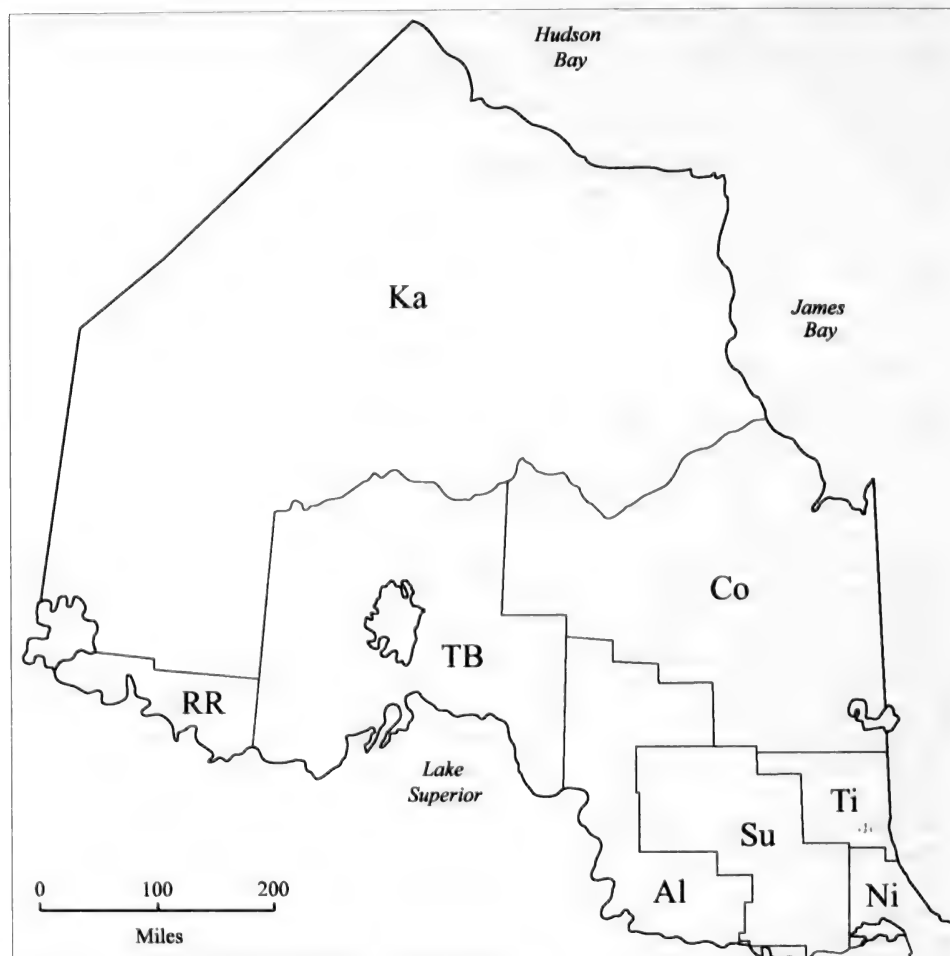


FIGURE 1. Districts of northern Ontario.

Abbreviations: Al – Algoma; Co – Cochrane; Ka – Kenora; Ni – Nipissing; RR – Rainy River; Su – Sudbury; TB – Thunder Bay; Ti – Timiskaming. Modified from: Brock University Map Library. Ontario – regional municipalities, counties & districts (PDF file). Software edition. St. Catharines, Ontario: Brock University Map Library. 2004. File name: ontario.pdf.

Other Abbreviations. Abbreviations for provinces and territories in Canada and for states in the United States are the same ones that are used by the postal systems in both countries (e.g. MB = Manitoba, MI = Michigan). Only one exception applies: records from the Province of Newfoundland and Labrador are recorded separately as “LB” (= Labrador) and “NF” (= Newfoundland excluding Labrador). Further abbreviations: ANSI = Area of Natural and Scientific Interest.

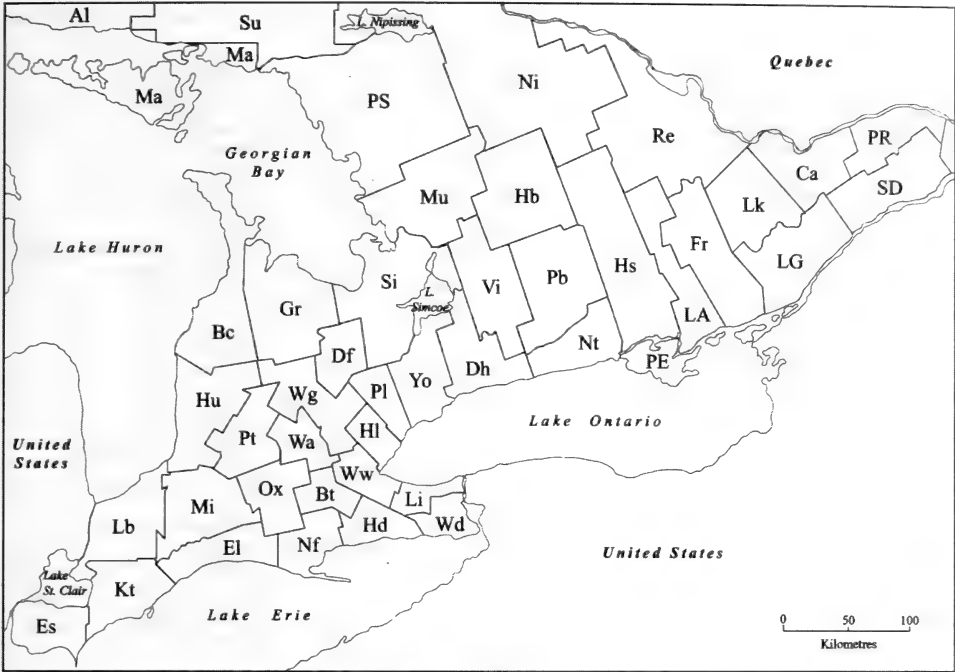


FIGURE 2. Counties and districts of southern Ontario.

Abbreviations: Al – Algoma; Bc – Bruce; Bt – Brant; Ca – Carleton; Df – Dufferin; Dh – Durham; El – Elgin; Es – Essex; Fr – Frontenac; Gr – Grey; Hb – Haliburton; Hd – Haldimand; Hl – Halton; Hs – Hastings; Hu – Huron; Kt – Kent; LA – Lennox and Addington; Lb – Lambton; LG – Leeds and Grenville; Li – Lincoln; Lk – Lanark; Ma – Manitoulin; Mi – Middlesex; Mu – Muskoka; Nf – Norfolk; Ni – Nipissing; Nt – Northumberland; Ox – Oxford; Pb – Peterborough; PE – Prince Edward; Pl – Peel; PR – Prescott and Russell; PS – Parry Sound; Pt – Perth; Re – Renfrew; SD – Stormont, Dundas and Glengarry; Si – Simcoe; Su – Sudbury; Vi – Victoria; Wa – Waterloo; Wd – Welland; Wg – Wellington; Ww – Wentworth; Yo – York. Modified from: Brock University Map Library. Southern Ontario (PDF file). Software edition. St. Catharines, Ontario: Brock University Map Library. 2004. File name: sont.pdf.

Results

A complete list of Ontario sphecids species is given in Table I. The table includes previous literature records (examples only), gives brief information on the distribution in Canada and North America, and records the presence of species in the five major collections studied. The following section (starting on p. 32) deals only with the species newly recorded from Ontario. Specimen data is only provided for species newly recorded from Ontario, supplemented with brief information on the overall distribution, biology, and prey records from examined material. New records from other provinces were also included if available. Table II gives an overview of the distribution of newly recorded species in Ontario counties, regions and districts. The status of some rare (but previously recorded species) is discussed on p. 74. Species that were erroneously recorded from Ontario are treated on pp. 75-76. Other misidentifications in previous papers (Harrington 1902; Walker 1913; Brown 1934; Blades and Marshall 1994) are corrected in a separate section (pp. 76-77).

TABLE I. Checklist of the spheciform wasps (Ampulicidae, Sphecidae, Crabronidae) of Ontario.

G	C	R	P	M	Species	Distribution (CDN)	Distr. (N.Am.)	Literature Records
Ampulicidae								
x	x		x		<i>Dolichurus greenei</i> Rohwer, 1916	Carol., Trans.	eastern	Krombein 1979
x	x		x		<i>Ampulex canaliculata</i> Say, 1823	Carol., Trans.	eastern	Finnamore & Michener 1993 *)
Sphecidae								
x		x		x	<i>Chlorion aerarium</i> Patton, 1879	Carolinian	transcont.	O'Brien 1989b
x	x	x	x	x	<i>Chalybion californicum</i> (Saussure, 1867)	NS to QC, BC	transcont.	H 1902, W 1913, F 1982
x					<i>Podium luctuosum</i> Smith, 1856	Carolinian	new (CDN)	
x	x	x	x	x	<i>Sceliphron caementarium</i> (Drury, 1773)	NS to QC, PE, BC	transcont.	H 1902, W 1913, BM 1963, SCS 2001
x	x	x	x	x	<i>Sphex ichneumoneus</i> (Linnaeus, 1758)	QC, BC	transcont.	W 1913, BM 1963, SCS 2001
x	x		x	x	<i>Sphex pensylvanicus</i> Linnaeus, 1763	QC	transcont.	new
x					<i>Isodontia apicalis</i> (Smith, 1856)	Carolinian	w. to AZ	new (CDN)
x	x	x			<i>Isodontia auripes</i> (Fernald, 1906)	(Carolinian)	eastern	new (CDN)
x	x	x	x		<i>Isodontia mexicana</i> (Saussure, 1867)	QC	e. of Rockies	BM 1963
			x		<i>Palmodus dimidiatus</i> (DeGeer, 1773)	(Carolinian)	transcont.	new (CDN)
x	x	x	x	x	<i>Prionyx atratus</i> (Lepeletier, 1845)	QC, SK, BC	transcont.	BM 1963
					<i>Prionyx canadensis</i> (Provancher, 1887)	MB to BC	transcont.	BM 1963
x			x		<i>Prionyx parkeri</i> Bohart & Menke, 1963	(Carolinian)	transcont.	new (CDN)
x	x	x	x	x	<i>Podalonia luctuosa</i> (Smith, 1856)	transcontinental	transcont.	H 1902, W 1913, Murray 1940
x	x	x	x	x	<i>Podalonia robusta</i> (Cresson, 1865)	transcontinental	transcont.	Murray 1940
x	x	x	x	x	<i>Podalonia violaceipennis</i> (Lepeletier, 1845)	QC	eastern	Murray 1940, SFG 1998
x	x	x	x	x	<i>Eremnophila aureonotata</i> (Cameron, 1888)	QC	e. of 100°W	SCS 2001
x	x	x	x	x	<i>Ammophila azteca</i> Cameron, 1888	transcontinental	transcont.	Krombein 1979 (n.e.)
x			x		<i>Ammophila cleopatra</i> Menke, 1964	AB, BC	transcont.	new
x	x	x	x	x	<i>Ammophila evansi</i> Menke, 1964	NS, QC	eastern	Menke 1964
			x	x	<i>Ammophila fernaldi</i> (Murray, 1938)	QC	w. to AZ	new
x	x	x	x	x	<i>Ammophila harti</i> (Fernald, 1931)	QC to AB	w. to UT	Menke 1965
x	x	x	x	x	<i>Ammophila kennedyi</i> (Murray, 1938)	transcontinental	transcont.	Krombein 1979 (n.e.)
x	x	x	x	x	<i>Ammophila mediata</i> Cresson, 1865	transcontinental	transcont.	Menke 1965
x		x	x		<i>Ammophila nigricans</i> Dahlbom, 1843	Carol., Trans.	eastern	new
x	x	x	x	x	<i>Ammophila pictipennis</i> (Walsh, 1869)	(Carolinian)	eastern	new (CDN)
x	x	x	x	x	<i>Ammophila procera</i> Dahlbom, 1843	QC to BC	transcont.	H 1902, W 1913
x	x	x	x	x	<i>Ammophila umaria</i> Dahlbom, 1843	QC	eastern	SFG 1998
Crabronidae, Pemphredoninae								
x	x	x	x	x	<i>Mimesa cressonii</i> Packard, 1867	QC to BC	transcont.	F 1983
x	x		x	x	<i>Mimesa dawsoni</i> Mickel, 1916	MB, AB	w. to UT	F 1983
x	x		x		<i>Mimesa ezra</i> (Pate, 1944)	NB, QC, AB	w. to CO	F 1983, SFG 1998
x	x		x		<i>Mimesa foxi</i> Finnamore, 1980	NF to AB, PE, NT	w. to WY	F 1983
x	x	x			<i>Mimesa gregaria</i> (Fox, 1898)	NS to BC, LB, NT, YT	transcont.	F 1983
x	x		x	x	<i>Mimesa huron</i> Finnamore, 1980	NS to QC	eastern	F 1983, SFG 1998
x	x	x			<i>Mimesa lutaria</i> (Fabricius, 1787)	LB to BC, PE, NT, YT	Holarctic	F 1983
x	x	x	x		<i>Mimesa maculipes</i> Fox, 1893	QC	eastern	F 1983
x	x	x	x	x	<i>Mimesa pauper</i> Packard, 1867	NF to BC, PE, NT	transcont.	F 1983, SFG 1998
x					<i>Mimesa pygidialis</i> (Malloch, 1933)	MB to AB	central	new
x	x	x			<i>Mimumesa atratina</i> (Morawitz, 1891)	LB, AB, BC, NT, YT	Holarctic	new
x	x	x	x	x	<i>Mimumesa canadensis</i> (Malloch, 1933)	transcontinental	transcont.	Krombein 1979
x					<i>Mimumesa clypeata</i> (Fox, 1898)	LB, SK, AB, NT, YT, (AK)	north.-mont.	new
x	x		x		<i>Mimumesa leucopus</i> (Say, 1837)	QC	eastern	new
x	x	x	x	x	<i>Mimumesa longicornis</i> (Fox, 1898)	NB	eastern	new (CDN)
x	x				<i>Mimumesa mellipes</i> (Say, 1837)	QC	eastern	new
x	x	x	x	x	<i>Mimumesa nigra</i> (Packard, 1867)	transcontinental	transcont.	H 1902, W 1913, B 1934, BMa 1994, SFG 1998
x	x	x			<i>Mimumesa propinqua</i> (Kincaid, 1900)	QC, AB, YT	transcont.	BMa 1994
x					<i>Mimumesa</i> sp.n. A	QC	northern	undescribed species
x	x				<i>Pseneo simplicicornis</i> (Fox, 1898)	QC	eastern	new
					<i>Psen barthi</i> Viereck, 1907	QC	eastern	new
x	x				<i>Psen erythropoda</i> Rohwer, 1910	QC	eastern	Krombein 1979
x	x				<i>Psen monticola</i> (Packard, 1867)	QC	eastern	Krombein 1979
x	x	x	x	x	<i>Psenulus pallipes</i> (Panzer, 1798)	QC	Holarctic	SFG 1998
x	x		x		<i>Psenulus trisulcus</i> (Fox, 1898)	QC	eastern	new
x			x		<i>Diodontus adamsi</i> Titus, 1909	SK to BC, YT	transcont.?	new (CDN)
x	x	x	x		<i>Diodontus bidentatus</i> Rohwer, 1911	NB, QC, AB	transcont.	new
x	x				<i>Diodontus flavitarsis</i> Fox, 1892	YT	transcont.	new
x	x	x	x	x	<i>Diodontus minutus</i> (Fabricius, 1793)	QC, BC	Holarctic	new
x	x				<i>Diodontus spiniferus</i> (Mickel, 1916)	AB, QC	transcont.	new
x	x		x		<i>Diodontus virginianus</i> (Rohwer, 1917)	Carolinian	transcont.	new (CDN)
x			x		<i>Pemphredon baltica</i> Mersuø, 1972	NB, BC, NT, YT	Holarctic	Dollfuss 1995
x	x	x	x	x	<i>Pemphredon foxii</i> Rohwer, 1917	NB to MB, AB	w. to AZ	Dollfuss 1995

TABLE I. – continued

G	C	R	P	M	Species	Distribution (CDN)	Distr. (N.Am.)	Literature Records
x	x	x	x	x	<i>Pemphredon inornata</i> Say, 1824	NS to BC, NT, YT	Holarctic	H 1902, Dollfuss 1995
x	x	x	x	x	<i>Pemphredon lethifer</i> (Shuckard, 1837)	NF to QC, PE, BC	Holarctic	Dollfuss 1995, SFG 1998
x	x	x			<i>Pemphredon lugubris</i> (Fabricius, 1793)	NF, NS, QC, AB, BC, YT	Holarctic	H 1902, Dollfuss 1995
x	x	x	x		<i>Pemphredon menkei</i> Bohart, 1993	NF, NB to MB, NT, YT	transcont.	Dollfuss 1995
x	x	x	x	x	<i>Pemphredon montana</i> Dahlbom, 1845	NF to BC, PE, YT	Holarctic	B 1934, Dollfuss 1995
x					<i>Pemphredon morio</i> vander Linden, 1829	?	intr., eastern	new (CDN)
					<i>Pemphredon pulawskii</i> Dollfuss, 1993	Carol., Trans.	eastern	Dollfuss 1995
x	x	x	x	x	<i>Pemphredon rugifer</i> (Dahlbom, 1844)	QC	intr.?, eastern	Dollfuss 1995
x	x	x	x	x	<i>Passaloecus annulatus</i> (Say, 1837)	MB, AB	e. of Rockies	H 1902
x	x	x			<i>Passaloecus areolatus</i> Vincent, 1978	Carol., Trans.	eastern	SFG 1998, SCS 2001
x					<i>Passaloecus borealis</i> Dahlbom, 1844	QC, BC, NT, YT	Holarctic	new
x	x	x	x	x	<i>Passaloecus cuspidatus</i> Smith, 1856	NS to BC, NT, YT	transcont.	H 1902, W 1913, Fye 1965, V 1978
x	x	x	x	x	<i>Passaloecus gracilis</i> (Curtis, 1834)	QC, AB	intr., eastern	new
x	x	x	x	x	<i>Passaloecus lineatus</i> Vincent, 1978	Carol., Trans.	eastern	SFG 1998
x	x	x	x	x	<i>Passaloecus monilicornis</i> Dahlbom, 1842	NB, QC, SK to BC, NT	Holarctic	Fye 1965, V 1978, SFG 1998
x	x	x	x	x	<i>Passaloecus singularis</i> Dahlbom, 1844	QC, BC	Holarctic	V 1978
x	x	x	x	x	<i>Stigmus americanus</i> Packard, 1867	transcontinental	transcont.	BMa 1994
x	x	x			<i>Stigmus fraternus</i> Say, 1824	QC	eastern	H 1902
x					<i>Spilomena amplexiceps</i> Krombein, 1952	Carol., Trans.	eastern	new (CDN)
x	x	x			<i>Spilomena barberi</i> Krombein, 1962	QC	transcont.	Krombein 1979
x	x				<i>Spilomena pusilla</i> (Say, 1837)	Carol., Trans.	transcont.	new (CDN)
x					<i>Ammoplatys lenape</i> Pate, 1937	Carol. to Can.	disjunct	new (CDN)
Crabronidae, Astatinae								
x	x	x	x		<i>Diplolepteron peglowi</i> Krombein, 1939	SK, NT, YT	transcont.	new
					<i>Astata bakeri</i> Parker, 1962	SK to BC	transcont.	Parker 1962
x	x	x			<i>Astata bicolor</i> Say, 1823	transcontinental	e. of Rockies	Krombein 1979 (n.e.)
x	x	x			<i>Astata leuthstromi</i> Ashmead, 1897	transcontinental	transcont.	Krombein 1979 (n.e.)
x					<i>Astata nubecula</i> Cresson, 1865	QC, AB, BC, NT	transcont.	new
x					<i>Astata occidentalis</i> Cresson, 1881	BC, Carolinian	transcont.	new
x	x	x	x		<i>Astata unicolor</i> Say, 1824	transcontinental	transcont.	H 1902, W 1913
Crabronidae, Crabroninae								
x	x				<i>Liris argentatus</i> (Beauvois, 1811)	BC, Carolinian	transcont.	Krombein 1979
x					<i>Liris beatus</i> (Cameron, 1889)	Carolinian	transcont.	new (CDN)
x	x	x	x	x	<i>Larropsis distincta</i> (Smith, 1856)	transcontinental	transcont.	H 1902, SFG 1998, SCS 2001
x	x	x			<i>Tachytes aurentulus</i> (Fabricius, 1804)	eastern Canada	eastern	Krombein 1979 (n.e.)
x	x	x	x	x	<i>Tachytes crassus</i> Patton, 1881	Carolinian	eastern	new (CDN)
x					<i>Tachytes harpax</i> Patton, 1881	Carol., Trans.	eastern	new (CDN)
x					<i>Tachytes intermedius</i> (Viereck, 1906)	Carol., Trans.	eastern	new (CDN)
x	x				<i>Tachytes pennsylvanicus</i> Banks, 1921	QC	transcont.	new
x	x	x	x	x	<i>Tachytes validus</i> Cresson, 1872	QC	w. to CO	Krombein 1979
x	x	x	x		<i>Tachysphex acutus</i> (Patton, 1880)	NB, MB	eastern	Pulawski 1988
x	x	x	x	x	<i>Tachysphex aethiops</i> (Cresson, 1865)	QC to BC, NT	transcont.	Pulawski 1988
x	x				<i>Tachysphex alpestris</i> Rohwer, 1908	MB to BC, NT, YT	west., e. to NE	new (CDN)
x	x	x	x		<i>Tachysphex antennatus</i> Fox, 1894	BC	transcont.	new
x					<i>Tachysphex apicalis</i> Fox, 1893	AB, BC, Carolinian	transcont.	new
x	x				<i>Tachysphex pechumani</i> Krombein, 1938	Carol., Trans.	eastern	Kurczewski 1998a, SCS 2001
x	x	x	x		<i>Tachysphex pompiiliformis</i> (Panzer, 1805)	NS to BC, PE, NT, YT	Holarctic	H 1902, Pulawski 1988
x	x	x			<i>Tachysphex semirufus</i> (Cresson, 1865)	SK to BC, YT	transcont.	Pulawski 1988
x	x	x	x	x	<i>Tachysphex similis</i> Rohwer, 1910	NB to AB, NT	w. to MT, UT	Pulawski 1988
x	x	x	x	x	<i>Tachysphex tarsatus</i> (Say, 1823)	QC to BC	transcont.	Pulawski 1988, SCS 2001
x	x	x	x	x	<i>Tachysphex terminatus</i> (Smith, 1856)	NS, PE, QC, MB, AB	w. to AZ	H 1902, Pulawski 1988
x	x				<i>Tachysphex texanus</i> (Cresson, 1872)	AB	transcont.	new
x	x	x	x	x	<i>Lyroda subita</i> (Say, 1837)	transcontinental	transcont.	H 1902, SFG 1998
x	x				<i>Plenoculus davisii</i> Fox, 1893	QC, BC	transcont.	new
x					<i>Solierella levis</i> Williams, 1950	Carol., Trans.	disjunct	new (CDN)
x	x				<i>Solierella peckhami</i> (Ashmead, 1897)	Carol. to Can.	transcont.	new (CDN)
x	x				<i>Solierella plenoculoides</i> (Fox, 1893)	Carol. to Can.	transcont.	new (CDN)
x	x	x	x		<i>Miscophus americanus</i> Fox, 1890	AB, NT	w. to CO	new
x					<i>Nitela cerasicola</i> Pate, 1937	Carolinian	eastern	new (CDN)
x	x	x	x		<i>Nitela virginianensis</i> Rohwer, 1923	QC	eastern	new
x					<i>Pison koreense</i> (Radoszkowski, 1887)	Carol., Trans.	intr., eastern	new (CDN)
x	x	x	x	x	<i>Trypoxylon attenuatum</i> Smith, 1851	QC	intr., eastern	new (CDN)
x					<i>Trypoxylon bidentatum</i> Fox, 1891	BC	disjunct	new (CDN)
x	x				<i>Trypoxylon carinatum</i> Say, 1837	Carol., Trans.	e. of 100°W	new (CDN)
x	x				<i>Trypoxylon clarkii</i> Krombein, 1962	Carolinian	eastern	new (CDN)
x	x	x	x	x	<i>Trypoxylon clavicerum</i> Lep. & Serville, 1828	Carol., Trans.	intr., eastern	Coville 1984
x	x	x			<i>Trypoxylon figulus</i> (Linnaeus, 1758)	QC	intr., eastern	Pulawski 1984, SFG 1998
x	x	x	x	x	<i>Trypoxylon frigidum</i> Smith, 1856	transcontinental	transcont.	H 1902, S 1940, SFG 1998

TABLE I. – continued

G	C	R	P	M	Species	Distribution (CDN)	Distr. (N.Am.)	Literature Records
x	x		x		<i>Trypoxylon johnsoni</i> Fox, 1891	Carolinian	eastern	Krombein 1979, SFG 1998
x	x		?		<i>Trypoxylon kolazyi</i> Kohl, 1893	Carol., Trans.	intr., eastern	new (CDN)
x	x	x	x	x	<i>Trypoxylon pennsylvanicum</i> Saussure, 1867	QC	w. to CO	S 1940, BMa 1994, SFG 1998
	x	x			<i>Trypoxylon richardsi</i> Sandhouse, 1940	Carolinian	eastern	Krombein 1979
		x			<i>Trypoxylon sculleni</i> Sandhouse, 1940	AB, BC	disjunct	new
x	x				<i>Trypoxylon clavatum</i> Say, 1837	Carolinian	e. of Rockies	S 1940
x	x	x	x		<i>Trypoxylon collinum</i> Smith, 1856	QC	eastern	S 1940, Coville 1982
x	x	x	x	x	<i>Trypoxylon lactitarse</i> Saussure, 1867	QC	w. to AZ	H 1902
x	x	x		x	<i>Trypoxylon politum</i> Say, 1837	(Carolinian)	eastern	Coville 1982
x					<i>Trypoxylon tridentatum</i> Packard, 1867	BC, Carolinian	transcont.	new
x	x	x	x	x	<i>Oxybelus bipunctatus</i> Olivier, 1811	NS to QC	intr., eastern	Kurczewski 1998b
x					<i>Oxybelus cressonii</i> Robertson, 1889	Carolinian	w. to UT	new (CDN)
x					<i>Oxybelus decorosus</i> (Mickel, 1916)	Carol. to Can.	e. of 100°W	new (CDN)
x	x	x	x	x	<i>Oxybelus emarginatus</i> Say, 1837	transcontinental	transcont.	H 1902
		x			<i>Oxybelus inornatus</i> (Robertson, 1901)	Carol., Trans.	eastern	new (CDN)
x					<i>Oxybelus laetus</i> Say, 1837	Carolinian	e. of 100°W	new (CDN)
x	x	x	x		<i>Oxybelus niger</i> Robertson, 1889	QC	eastern	Krombein 1979 (n.e.)
		x			<i>Oxybelus sericeus</i> Robertson, 1889	Carol. to Can.	transcont.	new (CDN)
x					<i>Oxybelus subcornutus</i> Cockerell, 1895	Carol., Trans.	w. to AZ	new (CDN)
x	x	x	x		<i>Oxybelus subulatus</i> Robertson, 1889	QC	w. to CO	Krombein 1979 (n.e.)
x	x	x	x	x	<i>Oxybelus uniglutinis</i> (Linnaeus, 1758)	transcontinental	Holarctic	H 1902, W 1913
x	x	x	x	x	<i>Anacrabro ocellatus</i> Packard, 1866	e. of Rockies	e. of Rockies	H 1902
x					<i>Entomognathus lenapeorum</i> Viereck, 1904	Carolinian	eastern	new (CDN)
x	x		x		<i>Entomognathus memorialis</i> Banks, 1921	Carolinian	eastern	new (CDN)
x	x	x	x	x	<i>Lindenius armaticeps</i> (Fox, 1895)	e. of Rockies	w. to CO	Krombein 1979 (n.e.)
x	x	x		x	<i>Lindenius columbianus</i> (Kohl, 1892)	transcontinental	transcont.	Krombein 1979 (n.e.)
x	x	x	x	x	<i>Rhopalum clavipes</i> (Linnaeus, 1758)	QC, AB	Holarctic	SFG 1998
x	x		x	x	<i>Rhopalum coarctatum</i> (Scopoli, 1763)	e. of Rockies	intr.?, eastern	BMa 1994, SFG 1998
x	x				<i>Rhopalum occidentale</i> (Fox, 1895)	QC, BC	transcont.	new
x	x	x			<i>Rhopalum pedicellatum</i> Packard, 1867	Carol. to Can.	w. to CO	new (CDN)
x	x		x		<i>Rhopalum rufigaster</i> Packard, 1867	QC	e. of 100°W	new
x					<i>Crossocerus unicus</i> (Patton, 1897)	QC, MB	w. to MT	new
x	x	x	x	x	<i>Crossocerus annulipes</i> (Lep. & Brullé, 1834)	NS to BC	Holarctic	SFG 1998, L 2000, SCS 2001
x	x				<i>Crossocerus barbipes</i> (Dahlbom, 1845)	QC to BC	Holarctic	H 1902, Pate 1944
x	x				<i>Crossocerus harringtoni</i> (Fox, 1895)	transcontinental	transcont.	Pate 1944, SFG 1998
x	x		x		<i>Crossocerus impressifrons</i> (Smith, 1856)	QC	eastern	H 1902, SFG 1998, L 2000, SCS 2001
x	x	x			<i>Crossocerus leucostoma</i> (Linnaeus, 1758)	transcontinental	Holarctic	H 1902, Pate 1944
					(syn.: <i>cinctipes</i> Provancher, 1882)			
x	x	x	x	x	<i>Crossocerus maculipennis</i> (Smith, 1856)	NB to BC	transcont.	H 1902, SFG 1998
x	x	x			<i>Crossocerus nigrilis</i> (Lepelletier & Brullé, 1835)	transcontinental	Holarctic	H 1902, B 1934, Pate 1944, L 2000
					(syn.: <i>nigricornis</i> Provancher, 1888)			
x	x		x		<i>Crossocerus nitidiventris</i> (Fox, 1895)	QC	eastern	Krombein 1979
x	x				<i>Crossocerus stictochilos</i> Pate, 1944	Carol., Trans.	eastern	L 2000
x	x				<i>Crossocerus tarsalis</i> (Fox, 1895)	QC	w. to ID	Krombein 1979
x	x	x	?		<i>Crossocerus elongatus</i> vand. Linden, 1829	NS, QC, AB, YT	Holarctic	SFG 1998, SCS 2001
x	x	x	?		<i>Crossocerus lentus</i> (Fox, 1895)	NB to BC, NT, YT	transcont.	SFG 1998, L 2000
x	x	x	x		<i>Crossocerus maculiclypeus</i> (Fox, 1895)	transcontinental	transcont.	F 1982, SFG 1998, SCS 2001
x					<i>Crossocerus minimus</i> (Packard, 1867)	NB, QC, AB, NT, YT	e. of Rockies	Krombein 1979
					<i>Crossocerus planifemur</i> Krombein, 1952	Carolinian	eastern	L 2000
x	x	x			<i>Crossocerus similis</i> (Fox, 1895)	Carolinian	eastern	Krombein 1979, L 2000
x	x	x			<i>Crossocerus tarsatus</i> (Shuckard, 1837)	transcontinental	Holarctic	Krombein 1979 (n.e.)
x	x	x	x	x	<i>Crabro advena</i> Smith, 1856	eastern Canada	e. of 100°W	H 1902, W 1913, SFG 1998
x	x	x	x	x	<i>Crabro argusinus</i> Bohart, 1976	transcontinental	transcont.	H 1902
x					<i>Crabro cognatus</i> Fox, 1895	AB	w. to MT, UT	new
x	x	x	x		<i>Crabro cribrellifer</i> (Packard, 1867)	NS, PE, QC	eastern	H 1902, Bohart 1976
					<i>Crabro digitatus</i> Bohart, 1976	QC	eastern	Bohart 1976
x	x	x			<i>Crabro latipes</i> Smith, 1856	transcontinental	transcont.	H 1902
x	x	x	x	x	<i>Crabro monticola</i> (Packard, 1867)	transcontinental	transcont.	Krombein 1979 (n.e.)
x					<i>Crabro nigriceps</i> Bohart, 1976	MB	eastern	new
x					<i>Crabro snowii</i> Fox, 1896	MB, SK	eastern	new
					<i>Crabro tenuiglossa</i> Packard, 1866	QC, AB	e. of Rockies	H 1902
x	x		x		<i>Crabro tenuis</i> Fox, 1895	QC to AB	transcont.	Krombein 1979 (n.e.)
x					<i>Crabro vernalis</i> (Packard, 1867)	NF, QC to MB, AB, BC, NT, YT	transcont.	new
x					<i>Ectemnius dilectus</i> (Cresson, 1865)	AB	transcont.	new
x	x	x			<i>Ectemnius rufifemur</i> (Packard, 1866)	e. of Rockies	e. of Rockies	Krombein 1979 (n.e.)
x	x	x	x	x	<i>Ectemnius lapidarius</i> (Panzer, 1804)	transcontinental	Holarctic	B 1934, BMa 1994, SFG 1998
x	x	x			<i>Ectemnius ruficornis</i> (Zetterstedt, 1838)	transcontinental	Holarctic	B 1934, BMa 1994
x	x	x	x		<i>Ectemnius cephalotes</i> (Olivier, 1792)	QC	intr., eastern	W 1913, SFG 1998

TABLE I. – continued

G	C	R	P	M	Species	Distribution (CDN)	Distr. (N.Am.)	Literature Records
x	x	x		x	<i>Ectemnius maculosus</i> (Gmelin, 1790)	eastern Canada	e. of 100°W	H 1902, W 1913, B 1934
x	x	x	x		<i>Ectemnius arcuatus</i> (Say, 1837)	transcontinental	transcont.	Krombein 1979 (n.e.)
x	x	x	x		<i>Ectemnius continuus</i> (Fabricius, 1804)	transcontinental	Holarctic	H 1902, SFG 1998
x		x			<i>Ectemnius decemmaculatus</i> (Say, 1823)	Carolinian	e. of Rockies	new (CDN)
x					<i>Ectemnius scaber</i> (Lepeletier & Brullé, 1834)	(Carolinian)	eastern	new (CDN)
x	x	x	x	x	<i>Ectemnius stirpicola</i> (Packard, 1866)	eastern Canada	e. of 100°W	Krombein 1979 (n.e.)
x	x	x		x	<i>Ectemnius trifasciatus</i> (Say, 1824)	transcontinental	transcont.	H 1902, B 1934
x	x	x	x		<i>Ectemnius atriceps</i> (Cresson, 1865)	transcontinental	transcont.	H 1902
x	x	x	x		<i>Ectemnius borealis</i> (Zetterstedt, 1838)	transcontinental	Holarctic	SFG 1998
x	x	x	x	x	<i>Ectemnius dives</i> (Lepeletier & Brullé, 1834)	transcontinental	Holarctic	H 1902, B 1934, SFG 1998
x	x	x	x		<i>Lestica confluenta</i> (Say, 1837)	transcontinental	transcont.	H 1902, W 1913
x	x	x	x	x	<i>Lestica producticollis</i> (Packard, 1866)	transcontinental	transcont.	H 1902, B 1934, SFG 1998, SCS 2001
Crabronidae, Bembicinae								
x					<i>Mellinus abdominalis</i> Cresson, 1882	AB	west., e. to ON	new
x	x		x		<i>Mellinus bimaculatus</i> Packard, 1867	Carol. to Can.	eastern	H 1902, SFG 1998, SCS 2001
x	x	x			<i>Alysson conicus</i> Provancher, 1889	NB to MB	eastern	H 1902
x	x	x	x		<i>Alysson guignardi</i> Provancher, 1887	transcontinental	transcont.	H 1902, SFG 1998
x	x				<i>Alysson melleus</i> Say, 1837	QC to MB	e. of 100°W	H 1902
x	x		x		<i>Alysson oppositus</i> Say, 1837	NB to MB	e. of Rockies	H 1902
x	x	x	x	x	<i>Alysson triangulifer</i> Provancher, 1887	transcontinental	transcont.	H 1902
x					<i>Didineis dilata</i> Malloch & Rohwer, 1930	SK, AB	w. to AB?	new (CDN)
x	x				<i>Didineis latimana</i> Malloch & Rohwer, 1930	QC	eastern	new (CDN)
x					<i>Didineis texana</i> (Cresson, 1872)	Carolinian	w. to AZ	new (CDN)
x	x				<i>Nysson daeckei</i> Viereck, 1904	NS to AB	eastern	new
x	x				<i>Nysson gagates</i> Bradley, 1920	QC to BC, YT	transcont.	new
x			x		<i>Nysson hesperus</i> Bohart, 1968	NB, MB, SK, BC, NT, YT	transcont.	new
x	x		x	x	<i>Nysson lateralis</i> Packard, 1867	NS to MB ¹⁾	eastern	H 1902
x					<i>Nysson simplicicornis</i> Fox, 1896	Carolinian	eastern	new (CDN)
x	x				<i>Nysson subtilis</i> Fox, 1896	QC	eastern	new (CDN)
x					<i>Synnevrus aequalis</i> (Patton, 1879)	Carolinian	eastern	new (CDN)
x	x	x			<i>Synnevrus plagiatus</i> (Cresson, 1882)	QC	transcont.	new
x	x				<i>Epinysson mellipes</i> (Cresson, 1882)	MB, BC	transcont.	new
x	x		x		<i>Epinysson transmericus</i> (Viereck, 1904)	MB ¹⁾	eastern	new (CDN)
x					<i>Epinysson tuberculatus</i> (Handlirsch, 1887)	Carolinian	eastern	new (CDN)
x	x	x	x		<i>Clitemnestra bipunctata</i> (Say, 1824)	QC, AB	transcont.	new
x	x				<i>Argogorytes nigrifrons</i> (Smith, 1856)	NS, QC	eastern	new
x	x	x	x		<i>Gorytes atricornis</i> Packard, 1867	transcontinental	transcont.	Krombein 1979 (n.e.)
x	x	x	x		<i>Gorytes canaliculatus</i> Packard, 1867	transcontinental	transcont.	H 1902
x	x	x	x		<i>Gorytes deceptor</i> Krombein, 1958	QC	eastern	Krombein 1979
x	x	x	x	x	<i>Gorytes similis</i> Smith, 1856	NS to BC	w. to CO	H 1902, W 1913, B 1934
x	x	x	x	x	<i>Pseudoplis phaleratus</i> (Say, 1837)	PE, QC	w. to CO, AZ	H 1902
x	x		x		<i>Lestiphorus cockerelli</i> (Rohwer, 1909)	NB, QC, NT	w. to CO	new
x			x		<i>Orytus gracilis</i> (Patton, 1879)	Carolinian	e. of 100°W	new (CDN)
x	x		x		<i>Sphecius speciosus</i> (Drury, 1773)	Carolinian	e. of Rockies	RD 1991a, SCS 2001
x	x		x		<i>Hoplisoides costalis</i> (Cresson, 1872)	Carol., Trans.	eastern, AK	new (CDN)
x	x	x	x		<i>Hoplisoides nebulosus</i> (Packard, 1867)	NB, PE, QC ¹⁾	eastern	H 1902
x	x		x	x	<i>Hoplisoides placidus</i> (Smith, 1856)	QC	eastern	new (CDN)
x					<i>Stizoides renicinctus</i> (Say, 1823)	AB, BC	transcont.	new
x	x	x	x		<i>Bicyrtes quadrifasciatus</i> (Say, 1824)	Carol., Trans.	of Rockies	new (CDN)
x	x	x	x	x	<i>Bicyrtes ventralis</i> (Say, 1824)	transcontinental	transcont.	H 1902, W 1913
x	x	x	x	x	<i>Microbembex monodonta</i> (Say, 1824)	e. of Rockies	e. of Rockies	H 1902, W 1913, SCS 2001
x					<i>Stictia carolina</i> (Fabricius, 1793)	Carolinian	w. to NM	new (CDN)
x	x	x	x	x	<i>Bembix americana</i> Fabricius, 1793	NB to BC	transcont.	H 1902, SCS 2001
x	x				<i>Bembix pruinosa</i> Fox, 1895	MB, AB	transcont.	Evans & Matthews 1968
x	x				<i>Stictiella emarginata</i> (Cresson, 1865)	SK, AB	transcont.	new
Crabronidae, Philanthinae								
x	x		x	x	<i>Philanthus albopilosus</i> Cresson, 1865	Carol., Trans.	west., e. to NY	Krombein 1979
x	x	x	x	x	<i>Philanthus bilunatus</i> Cresson, 1865	NS to AB, PE	w. to CO, NM	H 1902, W 1913, B 1934, SCS 2001
x	x	x	x	x	<i>Philanthus gibbosus</i> (Fabricius, 1775)	QC to MB, BC	transcont.	SCS 2001
x	x		x	x	<i>Philanthus lepidus</i> Cresson, 1865	QC to MB	w. to CO	new
x	x	x	x	x	<i>Philanthus politus</i> Say, 1824	QC	eastern	H 1902, SFG 1998, SCS 2001
x	x	x	x	x	<i>Philanthus sanbornii</i> Cresson, 1865	MB	w. to NM	Krombein 1979
x	x	x	x	x	<i>Philanthus solivagus</i> Say, 1837	NS, QC	eastern	H 1902, W 1913, B 1934
x	x	x	x	x	<i>Philanthus ventralis</i> Fabricius, 1798	QC, AB, BC	transcont.	Krombein 1979 (n.e.)
x	x	x	x	x	<i>Aphilanthops frigidus</i> (Smith, 1856)	transcontinental	transcont.	H 1902, SCS 2001
x	x	x	x	x	<i>Cerceris arelate</i> Banks, 1912	QC	eastern	Scullen 1965

TABLE I. – continued

G	C	R	P	M	Species	Distribution (CDN)	Distr. (N.Am.)	Literature Records
x	x				<i>Cerceris astarte</i> Banks, 1913	Carol., Trans.	eastern	new
x	x	x	x	x	<i>Cerceris atramontensis</i> Banks, 1913	QC	eastern	Scullen 1965, SFG 1998
x	x			x	<i>Cerceris clypeata</i> Dahlbom, 1844	QC	eastern	Scullen 1965
		x			<i>Cerceris compacta</i> Cresson, 1865	Carolinian	transcont.	new (CDN)
x	x		x		<i>Cerceris crucis</i> Viereck & Cockerell, 1904	AB, BC	transcont.	new
x	x	x	x		<i>Cerceris dentifrons</i> Cresson, 1865	QC	eastern	Scullen 1965
x	x	x	x		<i>Cerceris deserti</i> Say, 1824	NB to AB	w. to CO	Scullen 1965
x	x				<i>Cerceris echo</i> Mickel, 1916	AB, BC, Carolinian	transcont.	new
x					<i>Cerceris finitima</i> Cresson, 1865	SK	transcont.	new
x	x	x	x		<i>Cerceris fumipennis</i> Say, 1837	BC, Carol., Trans.	transcont.	new
x	x				<i>Cerceris halone</i> Banks, 1912	MB	e. of Rockies	new
x					<i>Cerceris insolita</i> Cresson, 1865	Carolinian	w. to AZ	new (CDN)
x	x				<i>Cerceris kennicottii</i> Cresson, 1865	Carolinian	w. to CO	new
x	x	x	x	x	<i>Cerceris nigrescens</i> Smith, 1856	QC to BC, NT, YT	transcont.	H 1902, W 1913, Scullen 1965
		x			<i>Cerceris nitidoides</i> Ferguson, 1983	QC	eastern	new
x					<i>Cerceris occipitomaculata</i> Packard, 1866	Carol., Trans.?	w. to CO, AZ	new
x	x				<i>Cerceris prominens</i> Banks, 1912	MB	eastern	new
x	x	x	x		<i>Cerceris rufopicta</i> Smith, 1856 (syn.: <i>robertsonii</i> Fox, 1893)	QC	eastern	Scullen 1965
		x	x		<i>Eucerceris zonata</i> (Say, 1823)	Carol., Trans.	w. to WY, CO	W 1913, Scullen 1968
					Doubtful record:			
x					<i>Eucerceris flavocincta</i> Cresson, 1865	MB to BC	e. to MB	new (loc. data correct?)

Explanations: The first five columns indicate the presence or absence of the species in the five largest collections: G – University of Guelph, C – Canadian National Collection, R – Royal Ontario Museum, P – Collection of Laurence Packer, M – University of Manitoba. Distribution (CDN): Distribution in Canada by provinces and territories; for species that are known from Ontario only the life zone(s) in which the species occurs is indicated: Can. – Canadian life zone, Trans. – Transition life zone, Carol. – Carolinian life zone, (Carolinian) – mostly Carolinian life zone but with some localities slightly north of it; ¹) unpublished data (further locality information will be provided in upcoming reviews of the genera *Nysson*, *Epinysson* and *Hoplisoides*). Distr. (N.Am.): Distribution in North America (includes previously unpublished data of the author in some cases): intr. – introduced; Holarctic – Holarctic species with transcontinental distribution in North America. Literature records: Only a selection of literature records is given. The Catalog of Hymenoptera in America North of Mexico (Krombein 1979) is only included if this is the earliest or the only reference; (n.e.) – not explicitly mentioned from Ontario but indicated range includes Ontario (see section on recording standards in Materials and Methods); B – Brown, BM – Bohart and Menke, BMa – Blades and Marshall, F – Finnermore, H – Harrington, L – Leclercq, RD – Romel and Dykstra, S – Sandhouse, SCS – Skevington et al., SFG – Sugar et al., V – Vincent, W – Walker; *) – indirectly mentioned.

TABLE II. Distribution within Ontario of newly recorded species of spheciform wasps (Sphecidae, Crabronidae).

Abbreviations for counties, regions and districts (same as in Figures 1, 2): Bt – Brant, El – Elgin, Es – Essex, Hd – Haldimand, Hl – Halton, Kt – Kent, Lb – Lambton, Li – Lincoln, Mi – Middlesex, Nf – Norfolk, Ox – Oxford, Wd – Welland, Ww – Wentworth, Bc – Bruce, Du – Dufferin, Gr – Grey, Hu – Huron, Pl – Peel, Si – Simcoe, Wa – Waterloo, Wg – Wellington, Yo – York, Ca – Carleton, Fr – Frontenac, Hs – Hastings, LG – Leeds and Grenville, Lk – Lanark, Nt – Northumberland, Pb – Peterborough, PE – Prince Edward, Vi – Victoria, Ma – Manitoulin, Mu – Muskoka, Ni – Nipissing, PS – Parry Sound, Re – Renfrew, Al – Algoma, Co – Cochrane, Ka – Kenora, RR – Rainy River, Su – Sudbury, TB – Thunder Bay. Note: The area included under the Carolinian Southwest slightly exceeds the northern limit of the Carolinian life zone.

Table II. Distribution within Ontario of newly recorded species of spheciform wasps (Sphecidae, Crabronidae).

[illegible]

Table II – continued

[illegible]

Table II – continued

[illegible]

Species newly recorded from Ontario

Family Sphecidae

Podium luctuosum Smith, 1856

Ontario: **Norfolk**, 1 ♀, Normandale Fish Culture Station, 24 July 2001, B. Arnal & H. Duggan (BAR); 5 ♀ ♀*), Turkey Point Provincial Park, east boundary, 42°42'37"N, 80°19'47"W, 17 August 2003, M. Buck.

Distribution. Genus and species newly recorded for Canada. Eastern U.S.: MI (O'Brien 1989b), NY to TX and FL, MO, KS (Bohart and Menke 1963; Krombein 1979).

Biology. Nests in borings in wood that are sealed with mud on the outer end. Prey are adults of *Parcoblatta uhleriana* (Saussure) and *P. virginica* (Brunner) (O'Brien 1989b).

Prey record. *) One nymphal roach, probably *Parcoblatta* sp.

Sphex pensylvanicus Linnaeus, 1763

Ontario: **Simcoe**, 1 ♂, Springwater Provincial Park, 44°26'33"N, 79°45'41"W, 2 September 2002, M. Buck. **Wellington**, Guelph, 3 ♂ ♂, 24 July 1978, B. Warner & S. Giamondi, 1 ♀, 18 August 1980, D.H. Pengelly, 1 ♀, 18 October 1995, H. Raikes; 1 ♀, Aberfoyle, 14 August 1983, W. Punchihewa. **Waterloo**, Cambridge, 1 ♂, 28 July 1975, S. Allan, 1 ♀, 4 August 1981, R.S. Onge, 1 ♂, 20 August 1984, grass field, M. Harvey. **Halton**, 1 ♀, Burlington, 16 August 1980, S. Appleby; Oakville, 1 ♂, 18 July 1976, 1 ♂, 31 August 1976, 1 ♂, 30 July 1977, 1 ♂, 3 August 1977, 2 ♂ ♂, 4 August 1978, W.A. Attwater, 1 ♀, 3 August 1977, A. Konecny, 3 ♂ ♂ 1 ♀, 4 July 1978, G. Sevean & M. Lichtenberg; 2 ♂ ♂ 1 ♀, Hamilton, Royal Botanical Garden, 22 August 1992, J. Skevington & A. Goering. **Wentworth**, Hamilton, 1 ♂, 17 August 1958, D.H. Pengelly, 1 ♀, 18 August 1975, no collector; 1 ♀, Hamilton, Cootes Paradise, 17 August 1959, no collector. **Brant**, 1 ♂, Brantford Railway Prairie, 43°10'N, 80°19'W, 24 August 2001, S.M. Paiero. **Oxford**, 1 ♀, Curries, 1955, C. Gracey. **Middlesex**, London, 5 ♂ ♂, 21 July, 1, 10 and 22 August 1990, R.W. Turnock (EDUM), 1 ♀, 2 August 1981, E. Zaborski. **Lambton**, 1 ♀, Forest, 17 July 1962, Kelton & Brumpton (CNCI). **Kent**, Rondeau Provincial Park, South Point Trail East, 1 ♂, 7 September 2002, oak savannah, M. Buck, 1 ♂, 16 July 2003, dunes, H. Carscadden, 1 ♂, 9 August 2003, oak savannah, M. Buck; 1 ♀, Rondeau Provincial Park, Spicebush Trail, 42°18'9"N, 81°51'6"W, 15 August 2003, Carolinian forest, S.M. Paiero; 1 ♂, Rondeau Provincial Park, Marsh Trail North, 42°18'N, 81°51'W, 15 August 2003, S.M. Paiero. **Essex**, Point Pelee, 1 ♀, 15 August 1971, B.K. Akey, 1 ♂, 28 July 1978, J. Cappleman, 1 ♀, 29 July 1978, D. Morris; Point Pelee National Park, West Beach, 1 ♂, 28 July 2003, M. Buck, 2 ♀ ♀), 13 August 2003, M. Buck & D. Cheung; Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 1 ♂, 29 July 2003, 1 ♂, 14 August 2003, M. Buck; 1 ♀), Point Pelee National Park, The Tip parking lot, 41°55'3"N, 82°30'37"W, 14 August 2003, D. Cheung; 1 ♂, Union-on-the-Lake, 23 August 1984, T.D. Galloway (EDUM); Kingsville, 1 ♀, 12 August 1964, F.R. Wetmore (CNCI), 1 ♂, 8 July 1977, W.A. Attwater; 1 ♂, River Canard, 10 July 1977, W.A. Attwater; 1 ♀, Harrow, 25 August 1997, K. Morneau; Windsor, 1 ♀, 1 August 1975, C.A. Schisler, 1 ♂, 27 July 1976, 1 ♀, 7 September 1976, J.F. Fortin, 1 ♀, 26 August 1984, E. Zaborski; 2 ♀ ♀, Windsor, Ojibway Prairie, 18 August 1983, K.N. Barber, 2 ♀ ♀, 1 August 1984, M.T. Kasserra, 1 ♂, 13-14 July 2001, 1 ♀, 30 August 2001, S.M. Paiero, 1 ♂, 20 July 2002, S.A. Marshall, 1 ♀, 26 August 2002, M. Buck; 1 ♂, Windsor, Springarden Road ANSI, 27 August 2002, M. Buck; 1 ♀, no locality or collector, 10 August 1951 (CASC).

Distribution. Newly recorded for Ontario. Canada: QC (adventitious? Finnamore 1982); transcontinental in U.S. except northwestern states, northern Mexico (Krombein 1979).

Biology. Nests in soft earth, often in sheltered areas. Tettigoniidae of the genera *Macrocentrum*, *Phaneroptera* and *Scudderia* are used as prey (Bohart and Menke 1976, O'Brien 1989b).

Prey records. ¹⁾ One adult male *Amblycorypha* cf. *oblongifolia* (De Geer) (Tettigoniidae). ²⁾ One adult female *Scudderia* cf. *furcata furcata* Brunner.

Isodontia (s. str.) *apicalis* (Smith, 1856)

Ontario: Essex, Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 1♂, 29 July 2003, 1♂ 3♀, 30 July 2003, 1♀, 14 August 2003, M. Buck.

Distribution. Newly recorded for Canada. Mostly eastern U.S.: NJ to FL, west to TX, also TN, NE, AZ (Bohart and Menke 1963).

Biology. Probably non-fossorial like other species of the genus (Krombein 1979). *Amblycorypha* (Tettigoniidae) has been recorded as prey (Bohart and Menke 1976).

Isodontia (*Murrayella*) *auripes* (Fernald, 1906)

Ontario: York, 1♀, Toronto, Don River, 9 July 1973, W.M.M. Edmonds (ROME); 1♀, Toronto, Waterfront, 7 August 1984, W.M.M. Edmonds (ROME). **Waterloo**, 1♀, Waterloo, nr. Albert McCormick Arena, July 2000, B. Arnal & H. Duggan (BAR). **Welland**, 1♀, Niagara Falls, Niagara Whirlpool, 1 July 2004, J. Klymko. **Middlesex**, 1♀, London, 15 August 1989, yellow pan, D. Ferris. **Kent**, 1♀, Thamesville, 30 June 1962, S.M. Clark (CNCI); 1♂, Chatham, 28 August 1947, R.J. Moore. **Essex**, 2♂♂, Point Pelee, 2 and 8 August 1920, "NKB" [= N.K. Bigelow] (ROME); 1♂, Point Pelee National Park, The Tip parking lot, 41°55'3"N, 82°30'37"W, 14 August 2003, D. Cheung; 2♂♂, Pelee I., 3 July 1950, V. Kohler (ROME); 2♂♂ 1♀, Kingsville, 8 July 1977, K.N. Barber; 1♀, River Canard, 10 July 1977, W.A. Attwater.

Distribution. Newly recorded for Canada. Eastern U.S.: NY and MI south to FL, west to KS and TX (Krombein 1979).

Biology. Has been reported to breed in burrows of *Melitoma* and *Anthophora* (Apidae) in a bluff, in carpenter bee burrows and in sumac stems (Bohart and Menke 1963). The prey consists of Gryllidae and Tettigoniidae (Krombein 1979).

Palmoda *dimidiatus* (DeGeer, 1773)

Ontario: Lambton, 1♀, Pinery Provincial Park, powerline, 15 July 1986, L. Packer (LPC).

Distribution. Newly recorded for Canada. Transcontinental in U.S.: MA to FL (incl. NY, PA, MI), west to ID and CA; northern Mexico (Bohart and Menke 1963).

Biology. Nests in sand. Tettigoniidae of the genera *Atlanticus*, *Dissosteira* and *Pediocetes* are used as prey (Krombein 1979).

Prionyx parkeri Bohart & Menke, 1963

Ontario: Wellington, 1♂, Guelph, 18 July 1976, W.A. Attwater. **Halton**, 2♂♂, Oakville, 7 July 1976, W.A. Attwater. **Lambton**, 1♀ (identification tentative, see below), Pinery Provincial Park, powerline, 15 July 1986, L. Packer (LPC).

Distribution. Newly recorded for Canada. Transcontinental in U.S.: CT and NY to WA, FL to CA (Bohart and Menke 1963). Despite intensive research, the species has not yet been found in Michigan (O'Brien 1989b). Mexico south to Isthmus of Tehuantepec (Bohart and Menke 1963).

Biology. Nests in a variety of soils. Prey are Acrididae (Krombein 1979).

Note. The female from Pinery cannot be identified with certainty because the diagnostic pubescence of the pronotal lobes is worn off.

***Ammophila cleopatra* Menke, 1964**

Ontario: Bruce, 1 ♀, Inverhuron Provincial Park, 44°17'33"N, 81°35'28"W, 2 July 2003, front dunes, white pans, M. Buck. **Kent**, 1 ♀, Rondeau Provincial Park, South Point Trail, 42°15'35"N, 81°50'53"W, 7 September 2002, savannah, M. Buck. **Essex**, Seacliffe, 2 ♂♂, 1 August 1975, 1 ♀, 15 August 1983, T.D. Galloway (EDUM); Point Pelee, 4 ♂♂ (2 from malaise trap), 17-18 July 1978, K.N. Barber & W.A. Attwater, 2 ♂♂ 1 ♀, 30-31 July 1978, J. Cappleman & W.A. Attwater, 1 ♂, 20 June 1981, C. Farivar, 1 ♂, 14 July 1982, C. Hare, 1 ♀, 17-18 July 2003, D. Cheung; Point Pelee National Park, Old Henry Camp, 41°57'35"N, 82°31'32"W, 2 ♂♂, 30 July 2003, M. Buck, 11 ♂♂ 5 ♀♀, white pans, M. Buck & D. Cheung; 7 ♀♀, Point Pelee National Park, The Tip parking lot, 41°55'3"N, 82°30'37"W, 14 August 2003, M. Buck; Point Pelee National Park, Visitor Centre, 1 ♀, 24 July 2003, S.M. Paiero, 1 ♀, 13 August 2003, M. Buck; Point Pelee National Park, West Beach, 1 ♂, 29 July 2003, 1 ♀, 13 August 2003, M. Buck; Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 1 ♀, 29 July 2003, D. Cheung, 1 ♂, 30 July 2003, netted, M. Buck, 7 ♂♂ 3 ♀♀, 14-15 August 2003, yellow and white pans, M. Buck & D. Cheung; 1 ♂, Pelee I., Fish Point, 14 August 1993, B. Larson.

British Columbia: 2 ♂♂, Ashcroft, Hat Creek, hydro camp, 3 October 1999, malaise trap, C.S. Guppy (BCPM).

Distribution. Newly recorded for Ontario and British Columbia. Canada: AB; transcontinental in U.S. but absent from northeastern states (no records from east of MI and north of SC), mainly western and montane; northern Mexico (Menke 1965).

Biology. Prey are caterpillars of the families Notodontidae and Noctuidae (O'Brien 1989b). In Michigan the species is restricted to dune areas (O'Brien 1989b).

***Ammophila fernaldi* (Murray, 1938)**

Ontario: Simcoe, 1 ♀, Borden, 30 August 1948, V.W. Greene (EDUM). **Norfolk**, 1 ♂, Walsingham, Regional Road 60 5.5 km W Jct. Hwys 59 & 24, Pteraphylla Farm, 19 August 1991, P.J. Carson (LPC).

Distribution. Newly recorded for Ontario. Canada: QC (Finnamore 1982), MB; U.S. east of Rocky Mts.; south into Mexico (Krombein 1979).

Biology. Nests in sandy soil. Prey are caterpillars of the family Noctuidae (Krombein 1979).

***Ammophila nigricans* Dahlbom, 1843**

Ontario: **Northumberland**, 1 ♂, Bewdley, 27 August 1963, J.D. van Loon. **York**, 1 ♂, Toronto, Humber River nr. old mill, 4 September 1999, T. Romankova (ROME). **Halton**, 1 ♂, Milton, 16 Mile Creek & 4th Line, 43°29'5"N, 79°46'27"W, 12 August 2001, river valley, S.M. Paiero. **Norfolk**, Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 1 ♂, 8 July 2000, 1 ♀, 25 July 2000, sandy field, M. Buck, 1 ♀, 3 August 2001, M. Parchami-Araghi. **Kent**, Rondeau Provincial Park, South Point Trail East, 42°15'35"N, 81°50'53"W, 5-7 September 2003, 2 ♀♀, white pans, 1 ♀, yellow pans, M. Buck. **Essex**, 1 ♂, Leamington, 17 August 1987, T.D. Galloway (EDUM); 1 ♂, Point Pelee, 18 July 1978, K.N. Barber; Windsor, Ojibway Prairie, 1 ♂, 13-14 July 2001, 1 ♂, 7 August 2001, 3 ♂♂, 8-9 July 2002, 1 ♂, 20 July 2002, 3 ♂♂ 3 ♀♀, 30-31 July 2002 (1 ♀ from white pans), 1 ♂, 13 August 2002, 1 ♂ 1 ♀, 26-27 August 2002, M. Buck, S.M. Paiero & S.A. Marshall; 1 ♀, Windsor, Ojibway Prairie nr. Sprucewood Avenue, 12-13 September 2002, yellow pans, M. Buck & S.M. Paiero.

Distribution. Newly recorded for Ontario. Eastern U.S. (incl. MI: O'Brien 1989b; NY: Kurczewski 1998c; VT: Finnamore 1982) south to TX (Krombein 1979). Menke (1965) recorded this species from "southern Canada" without mentioning a province.

Biology. Nests in sandy-clay soil. Prey are caterpillars of the family Noctuidae (Krombein 1979).

***Ammophila pictipennis* (Walsh, 1869)**

Ontario: York, Toronto, 1♂, 10 September 1952, M.E. Hearst (ROME), 1♂, 30 August 1963, J.D. van Loon. **Wellington,** Guelph, 1♀, 12 September 1959, R.E. Crawford, 1♀, 3 August 1975, J.M. Cumming, 1♀, 22 July 1979, G.M. Eden, 1♀, 4 August 1979, W.T. Nash, 1♂, 19 July 2000, M. Cripps, 1♀, 21 September 2002, gravelly wasteland, M. Buck; 1♂, Guelph, along Eramosa River, 8 August 1993, B. Larson & J. Glaser. **Welland,** 1♀, Niagara Falls, June 1956, H.W.H. Zavitz. **Lincoln,** 1♀, Jordan, 9 September 1914 (CNCI); 1♀, Vineland, 9 July 1929, W.L. Putman (CNCI); 1♀, Vineland Station, 9 September 1942, H.R. Boyce (CNCI). **Norfolk,** 1♂, Turkey Point, September 1943, E.G. Ford (ROME). **Lambton,** 1♀, Pinery Provincial Park, powerline, 15 July 1986, L. Packer (LPC). **Essex,** Point Pelee, 2♂♂ 2♀♀, 9 September 1954 (CNCI), 1♀, 1 July 1978, D. Morris; 1♂, Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 14-15 August 2003, yellow pans, M. Buck & D. Cheung; 1♂, Point Pelee National Park, Old Henry Camp, 41°57'35"N, 82°31'32"W, 14-15 August 2003, white pans, M. Buck & D. Cheung; 1♀, Harrow, 6 September 1959, D.H. Pengelly.

Distribution. Newly recorded for Canada. Most of U.S. east of Rocky Mts. (incl. MI: O'Brien 1989b; NY: Kurczewski 1998c); south into central Mexico (Menke 1965).

Biology. Nests in sand. Prey are caterpillars of the families Noctuidae, Geometridae and Hesperidae (Menke 1965).

Family Crabronidae

Subfamily Pemphredoninae

***Mimesa pygidialis* (Malloch, 1933)**

Ontario: Cochrane, 2 ♀♀, Nellie Lake, 10 August 1961, G.K. Morris.

Distribution. Newly recorded for Ontario. Canada: MB, SK, AB; U.S.: MI, IL, WI (Finnamore, 1983), CO (Krombein 1979).

Biology. Unknown.

***Mimumesa atratina* (Morawitz, 1891)**

Ontario: Cochrane, 1♂, Nellie Lake, 10 August 1961, G.K. Morris. **Thunder Bay,** 15 ♂♂ 1♀, Neys Provincial Park, Prisoner's Cove nr. Little Pic River, 48°47'28"N, 86°37'48"W, 16 and 18 July 2002, beach, M. Buck. **Rainy River** (probably), 1♂ 1♀, Island Falls, 24 August 1959, S.M. Clark (CNCI). **Sudbury,** 1♀, Capreol, 15 August 1972, W.M.M. Edmonds (ROME).

Labrador: 10♂♂ 3 ♀♀, Goose Bay, 13 July-13 August 1948, H.C. Friesen & W.E. Beckel (CNCI). **Alberta:** McMurray, 1♂, 20 June 1953, 1♂ 1♀, 22 June 1953, G.E. Ball (CNCI). **British Columbia:** 32 mi SW Terrace, 1♀, 8 June 1960, 1♂, 6 July 1960, C.H. Mann (CNCI); 1♀, Lower Post, 19 June 1948, W.R.M. Mason (CNCI); 1♀, Port Nelson, 26 August 1948, W.R.M. Mason (CNCI). **Northwest Territories:** Norman Wells, 1♂, 15 July 1949, 2♀♀, 29 and 30 July 1949, W.R.M. Mason (CNCI).

Distribution. Newly recorded for Ontario, Labrador, Alberta, British Columbia and the Northwest Territories. Canada: YT (Finnamore 1997); Europe, Japan (Lomholdt 1975-76).

Biology. Nests in dry, decayed wood, often in abandoned insect borings. The prey consists of Issidae (Lomholdt 1975-76).

Species recognition. The female of this species keys to *M. propinqua* auctt. nec Kincaid in Malloch (1933). It can be distinguished from females of other *Mimumesa* species with broad pygidial plates by the black flagellum, the punctate (not longitudinally striate) mesoscutum, and the all-black metasoma. The male keys to *M. nigra* (Packard) in Malloch (1933). Both sexes differ from other Ontario species (except *Mimumesa* sp. n. A, see below) by the presence of an epicnemial carina (cf. Lomholdt 1975-76).

***Mimumesa clypeata* (Fox, 1898)**

Ontario: Thunder Bay, 1♂, Neys Provincial Park, Prisoner's Cove nr. picnic area, 48°46'49"N, 86°36'53"W, 18 July 2002, beach, M. Buck.

Distribution. Newly recorded for eastern Canada. Canada: AB (Finnamore 1994), YT (Finnamore 1997), NT; western U.S.: AK, WA, ID south to CA, NV, UT (Krombein 1979).

Biology. Unknown.

***Mimumesa leucopus* (Say, 1837)**

Ontario: Leeds and Grenville, 1♀, Greenbush, 9 September 1997, roadside, flight intercept trap, R. Hainault (CNCI). **Hastings,** 1♀, Trent River Prairie [NE of Stirling], 44°13'N, 77°34'W, 1-10 August 1994, J.T. Kerr & L. Packer (DEBU). **Halton,** 1♂, Bronte Creek Provincial Park, 11 August 2002, S.M. Paiero. **Wentworth,** 1♀, Ancaster, Newton Woods, 24 June-2 July 1996, forest, malaise trap, B. DeJonge. **Norfolk,** 1♀, Manestar Tract, 42°43'N, 80°27'W, 27-30 June 1992, oak savannah, malaise trap, P.J. Carson (LPC); 2♀♀, Simcoe Jct., 42°51'N, 80°18'W, 14-26 August 1994, oak savannah, malaise trap, J.T. Kerr, M. deGiusti & L. Packer (LPC). **Kent,** 1♂, Rondeau Provincial Park, 16 July-18 September 1979, mature forest, L. Masner (CNCI). **Essex,** 1♂, Point Pelee, 25 June 1979, W.A. Attwater; 3♀♀, Windsor, Ojibway Prairie, 18-19 June 2002, yellow pans (excl. 1♀), M. Buck & S.M. Paiero.

Distribution. Newly recorded for Ontario. Canada: QC (Finnamore 1982), AB; eastern U.S.: NH, MD, DC, VA, IN, IL (Krombein 1979). Blades & Marshall (1994) erroneously recorded the species from Ontario (see section on misidentifications [pp. 76-77]).

Biology. Unknown.

Species recognition. The species is interpreted here following Finnamore (1982). His key to *Mimumesa* species was based on information provided by J.P. van Lith who intended to revise the genus. Unfortunately, van Lith's work was never published. In Malloch (1933) females of both *M. leucopus* and *M. propinqua* (Kincaid) key to the former. Malloch's female *M. propinqua* is in fact *M. atratina* (Morawitz).

***Mimumesa longicornis* (Fox, 1898)**

Ontario: Norfolk, 1♀, Normandale, 4 September 1954, C.D. Miller (CNCI); 1♀, Manestar Tract, 42°43'N, 80°27'W, 4-12 August 1992, oak savannah, malaise trap, J.T. Kerr, M. deGiusti & L. Packer (LPC). **Lambton,** 1♂, Walpole I. Potawatomi Prairie, 42°33'N, 82°29'W, 19-25 July 2001, malaise trap, Guidotti et al. (ROME). **Essex,** 1♀, Point Pelee, 19 July 1978, K.N. Barber; Windsor, Ojibway Prairie, 1♀, 28-30 August 2001, unburnt prairie, yellow pans, S.M. Paiero, 1♀, 12-13 September 2002, yellow pans, M. Buck, 1♀, same except on earth between roots of fallen tree, S.M. Paiero.

New Brunswick: 1♀, Kouchibouguac National Park, 15 August 1978, S.J. Miller (CNCI).

Distribution. Newly recorded for Canada (ON, NB). Eastern U.S.: RI, NY to FL, LA, IA; Cuba, Central America (Krombein 1979).

Biology. Unknown.

***Mimusesa mellipes* (Say, 1837)**

Ontario: Carleton, 2 ♀♀, Ottawa, 9 July 1983, L. Leblanc (CNCI). **Wellington,** 1 ♀, Guelph, 29 June 1978, malaise trap, K.N. Barber; 1 ♀, Guelph, University Arboretum, 1-15 July 1991, malaise trap, M. Montes Castillo. **Wentworth,** 1 ♂, Flamborough, Lawson Farm, 43°18'58"N, 80°2'26"W, 30 June 2003, alvar, yellow pans, M. Buck.

Distribution. Newly recorded for Ontario. Canada: QC (Finnamore 1982); eastern and central U.S.: NY, MD, DC, OH, IN, IL, IA, NE (Krombein 1979).

Biology. Unknown.

***Mimusesa* sp. n. A**

Ontario: Algoma, 1 ♂, Lake Superior Provincial Park, 18 June 1972, B.D. Beam.

New Brunswick: 1 ♂, Kouchibouguac National Park, 6 July 1978, S.J. Miller (CNCI).

Distribution. Ontario, New Brunswick, also in northern Quebec (Buck, in prep).

Biology. Unknown.

Species recognition. This species is related to *M. atratina* with which it shares the complete epicnemial carina. The male differs from that species in having relatively broad elliptical tyloids on flagellomeres V-IX (less developed ones on FIV and FX) thus resembling the Palaearctic species *M. dahlbomi* (Wesmael). Female unknown. The specimen from Lake Superior Provincial Park bears a determination label "*Psen* (*Mimusesa*) *columbianus* Gittins ♂ det. van Lith 1976". *M. columbianus* Gittins is a manuscript name that was never published.

***Pseno simplicicornis* (Fox, 1898)**

Ontario: Renfrew, 1 ♀, Griffith, 17 August 1985, B.E. Cooper (CNCI). **Norfolk,** 1 ♀, Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 25 July 2000, sandy field, white pans, M. Buck.

Distribution. Genus and species newly recorded for Ontario. Canada: QC (van Lith 1975); eastern U.S.: NJ, PA to NC (Krombein 1979).

Biology. The species nests in dead wood and uses leafhoppers of the genus *Graphocephala* as prey (Krombein 1979).

***Psen barthi* Viereck, 1907**

Ontario: Leeds and Grenville, 1 ♀, St. Lawrence Is. National Park, McDonald I., 4 August 1976, A. Carter (CNCI). **Carleton:** 1 ♂ (identification tentative, see below), Ottawa, 8 July 1989, J.R. Vockeroth (CNCI).

Distribution. Newly recorded for Ontario. Canada: QC; eastern U.S.: WI, PA, CT, MD, GA (Krombein 1979).

Biology. Nests in wood. Prey are species of the genera *Atymna*, *Cyrtolobus* and *Microtalis* (Membracidae) (Krombein 1979).

Note. The male is only tentatively identified as this species because the metasomal petiole is unusually long (twice as long as tergite 1). No other species of *Psen* is known from eastern North America besides the three species recorded from Ontario (see Table I).

***Psenulus trisulcus* (Fox, 1898)**

Ontario: Algoma, 1 ♀, Hilton Township, 23 August 1992, edge of hardwood forest and field, malaise trap, J.E. Swann. **Carleton,** 1 ♀, Ottawa, no date/collector (CNCI). **Leeds and Grenville,** 1 ♀, St. Lawrence Is. National Park, Grenadier I. Centre, 24 June 1975, malaise trap (CNCI). **Hastings,** 1 ♀, Trent River Prairie [NE of Stirling], 44°13'N, 77°34'W, 1-10 August 1994.

J.T. Kerr & L. Packer (LPC). **Norfolk**, Manestar Tract, 42°43'N, 80°27'W, 2♀♀, 18-30 July 1992, oak savannah, malaise trap, P.J. Carson (LPC, DEBU); same except 1♀, 30 July-4 August 1992, 1♀, 4-12 August 1992, J.T. Kerr, M. deGiusti & L. Packer (LPC). **Lambton**, Pinery Provincial Park, powerline, 1♂, 4-6 June 1986 (DEBU), 2♂♂, 7-10 June 1986, 1♂, 18-21 June 1986, L. Packer (LPC). **Kent**, 1♀, Rondeau Provincial Park, South Point Trail, east parking lot, 42°15'42"N, 81°50'49"W, 16-29 July 2003, oak savannah, malaise trap, S.A. Marshall. **Essex**, 1♂, Point Pelee National Park, de Laurier Trail, 8 June 2000, O. Lonsdale.

Distribution. Newly recorded for Ontario. Canada: QC (Finnamore 1982); eastern and central U.S.: NH to TN, MO, KS (Krombein 1979).

Biology. Species of this genus nest in pre-existing cavities in twigs, stems, grass or beetle-borings in wood. Prey are Aphididae and Psyllidae (Krombein 1979).

Diodontus adamsi Titus in Adams, 1909

Ontario: Thunder Bay, 7♀♀, Neys Provincial Park, railway crossing, 48°46'30"N, 86°35'3"W, 17-18 July 2002, M. Buck; 1♀, Little Pic River at Hwy 17, 48°48'5"N, 86°37'47"W, 17 July 2002, M. Buck; 1♀, Sleeping Giant Provincial Park, 2.5 km S Visitor Centre, 48°20'53"N, 88°48'11"W, 9 July 2002, old sand pit, M. Buck; 1♀, Sleeping Giant Provincial Park, Tee Harbour, 48°19'32"N, 88°52'48"W, 12 July 2002, beach, M. Buck. **Algoma**, Icewater Creek watershed, 13.5 km NNE Searchmont, Whitman Dam Road mi 11.5, 2♀♀, 20 June 1986, 1♀*, 3 July 1986, sandy access road, K.N. Barber. **Sudbury**, 2♂♂, Sudbury, 16 and 18 June 1892, no collector (CNCI); 1♀, Noëlville, 28 June 1975, R.E. Roughley. **Renfrew**, 1♂, Petawawa, 7 June 1961, J.R. Vockeroth (CNCI). **Lambton**, Pinery Provincial Park, 1♀, 4-6 June 1986, malaise trap, L. Packer (LPC), 1♀, 10 June 1995, J. Skevington; 1♀, Pinery Provincial Park, powerline, 18-21 June 1986, malaise trap, L. Packer (DEBU); Port Franks, Watson Property nr. L-Lake, 2♀♀, 8-10 June 1996, 1♀, 13-15 June 1996, malaise trap, J. Skevington.

Saskatchewan: 1♀, Nipawin, 4 August, 1968, T.C. Taylor. **Alberta:** 2♀♀, Jasper, 2 and 7 July 1971, D.H. Pengelly. **British Columbia:** 17♂♂ 1♀, Atlin, 14 July 1955, H. Huckel (CNCI); 9♂♂ 3♀♀, Robson, various dates, May-June, 1947-50, H.R. Foxlee (CNCI). **Yukon Territory:** 1♀, Carcross, aspen parkland, 25-28 July 1988, M. Polak & M. Wood (CNCI).

Distribution. Newly recorded for Canada (ON, SK, AB, BC, YT). U.S.: MI (Eighme 1989).

Biology. Unknown. Members of this genus generally nest in the ground.

Prey record. *) One unidentified aphid.

Species recognition. Males of *D. adamsi*, *flavitaris*, and *virginianus* cannot be identified with the current literature. The male of *adamsi* has not been described and is not included in Eighme's (1989) key. Both sexes of *D. adamsi* can be distinguished from the other two species by the denser and more extensive pubescence of the fore wing median cell (in *flavitaris* and *virginianus* basal 2/3 of this cell largely bare to very sparsely setose except along fore margin) and the more densely punctate and less shining scutum. The colour of the pronotal lobe varies from black to yellow in *D. adamsi* males.

Diodontus bidentatus Rohwer, 1911

Ontario: Cochrane, 1♀, Moose Factory, 27 August 1959, S.M. Clark (CNCI); 1♂, Hearst, 22 August 1964, G. Knerer (ROME). **Thunder Bay**, 1♂, Neys Provincial Park, railway crossing, 48°46'30"N, 86°35'3"W, 17 July 2002, M. Buck; 4♂♂ 2♀♀, Neys Provincial Park, 1.6 km SW of gate house, 48°46'39"N, 86°36'32"W, 8-19 July 2002, *Vaccinium*/lichen, yellow pans, M. Buck; 2♂♂ 3♀♀, Little Pic River at Hwy 17, 48°48'5"N, 86°37'47"W, sand cliff, 15 and 17 July 2002, M. Buck; 1♂ 2♀♀, 28 km E Nipigon, 48°58'0"N, 87°58'47"W, 8 July 2002, M. Buck; 3♂♂ 5♀♀, Sleeping Giant Provincial Park, 2.5 km S Visitor Centre, 48°20'53"N, 88°48'11"W, 9 and

14 July 2002, old sand pit, M. Buck; 3♂♂ 1♀, Sleeping Giant Provincial Park, Marie Louise Lake Campground, 9-14 July 2002, white pans, M. Buck; 1♂, Thunder Bay, 1 July 1970, K.J.G. Deacon. **Nipissing**, 1♀, Algonquin Provincial Park, Lake Travers Road at hydro cut, 45°58'9"N, 77°50'37"W, 17 August 2002, M. Buck; 1♀, "Penage L." [= Penaish Lake?], 29 June 1961, *Rubus*, G. Knerer (ROME). **Parry Sound**, 1♂, Pointe au Baril, 6 August 1978, B. Warner. **Manitoulin**, 1♂, Manitoulin I., Carter Bay, 45°36'23"N, 82°8'27"W, 24 June 2003, dunes, M. Buck. **Carleton**, 1♂ 12♀♀, Ottawa, 10 and 16 September 1913, 9 and 10 October 1913, 30 August 1914, (1♀ from sand pit) F.W.L. Sladen (CNCI); 1♀, "J.F./Otta[wa]" (label cut off) from W.H. Harrington collection; Ottawa, 1♂, "30.7", 1♀, "11.6", "8. *P. mandibularis* carries a green aphid", 1♀, "139", "*Passalocus mandibularis* Ar. 20.6.85", probably from Guignard's collection (CNCI). **Carleton or Renfrew**, 1♂, Arnprior, Marshall Bay, 4 August 1913, C.G. Hewitt (CNCI). **Hastings**, 1♂ 2♀♀, Madoc, 21 June 1954, J.C. Martin (CNCI); Marmora, 1♀, 10 July 1952, 2♀♀, 19 July 1952 (malaise trap), J.R. Vockeroth (CNCI); 1♂, Marmora area, 11 August 1959, L.K. Smith (CNCI); Chatterton, 1♀, 15 June 1955, 2♂♂, 24 July 1956, J.C. Martin (CNCI); Belleville, 1♀, 5 August 1931, W.E. Steenburgh (CNCI), 1♀, 16 July 1950, J.C. Fisher, 1♀, no date/collector (CNCI); 2♂♂, Frankford, 23 June 1954, J.C. Martin (CNCI); 1♀, Sydney Township, 17 June 1965, no collector (CNCI). **Northumberland**, 1♂, Brighton, 7 July 1954, J.C. Martin (CNCI). **Bruce**, 1♂, Tobermory, 23 June 2002, bog, S.A. Marshall; 2♀♀, Dyers Bay, 17 July 1953 and 20 July 1954, D.H. Pengelly. **Grey**, 1♀, Ceylon, 18 June 1959, D.H. Pengelly. **Simcoe**, 1♀, Baxter, Six-Mile Lake, 8 July 1981, L. Packer (LPC). **Dufferin**, 1♂, Primrose, 7 July 1960, D.H. Pengelly. **Wellington**, 1♂, Guelph, 11 July 1956, D.H. Pengelly; 1♂, Arkell, 23 June 1959, D.H. Pengelly; Eramosa, 1♂, 25 July 1959, 1♀, 18 July 1959, R.E. Crawford. **Wentworth**, 1♀, Ancaster, 8 August 1969, J.E.H. Martin (CNCI).

Quebec: 1♂, Kazabazua, 24 July 1913, F.W.L. Sladen (CNCI).

Distribution. Newly recorded for Ontario and Quebec. Canada: AB (Finnamore 1994), NB; U.S.: MI, NY, PA, ND, MT, ID, CO, AK (Krombein 1979; Eighme 1989).

Biology. Unknown.

Diodontus flavitarsis Fox, 1892

Ontario: **Carleton**, 2♂♂, Ottawa, 23 August 1959, J.R. Vockeroth (CNCI, DEBU); 1♂, same except 17 July 1989, damp second-growth *Acer-Betula* wood (CNCI). **Essex**, 1♀, Harrow, 13 August 1976, C.D. Neilsen.

Distribution. Newly recorded for eastern Canada. Canada: YT (Finnamore 1997); western U.S.: WA to CA, east to IA, MO, TX, rare in the east (PA, DC) (Eighme 1989).

Biology. Unknown.

Species recognition. Males of this species are difficult to separate from *D. virginianus* (see also note under *D. adamsi*). Eighme (1989) distinguished males of *flavitarsis* and *virginianus* based on the colour of the pronotal lobes. Unfortunately, this character is variable in *virginianus* (ranging from black to yellow). Both sexes of *flavitarsis* can be distinguished from *virginianus* by the slightly more produced and acute lateral angle of the transverse pronotal carina (difference usually clearer in females). Additionally, yellow coloration elements are usually developed better in *flavitarsis* males (tegula usually yellow to the summit, hind tibia yellow dorsally at least at base).

Diodontus minutus (Fabricius, 1793)

Ontario: Manitoulin, Manitoulin I., Carter Bay, 45°36'23"N, 82°8'27"W, 11♂♂ 8♀♀, 23-24 June 2003, 4♂♂ 1♀, 13 July 2003, dunes, M. Buck. **Carleton**, 16♂♂ 5♀♀, Ottawa, May-September, 1952-1975, various collectors (all except 2♂♂ CNCI). **Lanark**, 2♀♀, Fallbrook, 14 August 1974, J.T. Huber; 1♀, 20 mi Clayton Road, 12 September 1984, H. Goulet & L. Masner (CNCI). **Lanark or Leeds and Grenville**, 1♀, Smiths Falls, 11 September 1950, J.C. Martin (CNCI). **Leeds and Grenville**, 1♂, Gananoque, 26 September 1981, R. St. Onge. **Hastings**, 3♂♂ 2♀♀, Shannonville, 24 August 1949, J.C. Martin (CNCI); 1♀, Belleville, 16 July 1949, J.C. Martin (CNCI). **Peterborough**, 7♂♂ 6♀♀, Norwood, various dates, 1975, 1982-84, T.D. Galloway (EDUM); 1♀, Serpent Mounds Provincial Park, 8 August 1983, T.D. Galloway (EDUM). **Peterborough or Brant**, 1♀, Mt. Pleasant, 10 July 1958, L.A. Kelton (CNCI). **Northumberland**, 1♂, Brighton, 21 July 1954, J.C. Martin (CNCI). **Bruce**, Inverhuron Provincial Park, front dunes, 44°17'33"N, 81°35'28"W, 2♂♂ 3♀♀ (2♀♀ in yellow pans), 2 July 2003, 1♂, 25 July 2003, M. Buck, 2♀♀, 10 September 2003, M. Buck & S.M. Paiero. **Bruce or Grey**, 2♀♀, Hepworth, 4 July 1954 and 31 May 1977, D.H. Pengelly & K.N. Barber. **Grey**, 4♂♂, Clarksburg, 16 August 1964, B.K.W. Wyatt; 2♂♂, Meaford, 14 June 1975, J.T. Huber. **Huron**, 1♂, Goderich, 22 June 1977, K.N. Barber. **Simcoe**, 1♀, Honey Harbour, 26 August 1959, D.H. Pengelly; 4♂♂, Midland, 9 June-15 July 1974, J.T. Huber. **Dufferin**, 15♂♂ 12♀♀, Primrose, July, 1955-1974, D.H. Pengelly & J.T. Huber; Mono Cliffs Provincial Park, 1♂ 4♀♀, 31 August 2002, 4♂♂, 21 June 2003, M. Buck. **York**, 1♂, Toronto, 24 July 1981, L. Packer (LPC). **Peel**, Forks of the Credit, 2♂♂ 1♀, 22 June 1965, G. Knerer (ROME), 2♂♂ 4♀♀, 5, 15, 18 and 26 August 1969, P. MacKay (ROME), 3♀♀, June 1981, L. Packer (LPC); 4♀♀, Forks of the Credit, gravel pit NW of Provincial Park, 43°49'24"N, 80°0'57"W, 3 and 5 August 2002, M. Buck; 1♂, Brampton, Churchville Pk., 28 June 1978, P.W. Scheffer (ROME). **Wellington**, 2♀♀, Belwood, 16 and 18 July 1972, D.H. Pengelly; 34♂♂ 11♀♀, Guelph, May-September, 1955-2002, various collectors; Aberfoyle, 1♀, 24 July 1974, W.D. Husby, 2♂♂, 25 June 1956, D.H. Pengelly; 8♂♂, Arkell, June-August, 1958, 1959, 1975, D.H. Pengelly & L.A. Barlow; 3♂♂, Elora, 6 September 1975 and 6 August 1981, L.A. Barlow & G. Aiudi. **Waterloo**, 5♀♀, Waterloo, 11 October 1976 and 31 July 1988, D. Levin & I.P. Smith; 1♀, Cambridge, 9 June 1980, C. Bolter. **Halton**, 2♂♂ 1♀, Aldershot, 7 July 1955, L.A. Kelton (CNCI); 1♀, Milton, Woodland Trails Camp, 4th Line Nassagaweya, 43°32'51"N, 79°59'35"W, 8 August 2002, S.M. Paiero; 1♂, Oakville, nr. Hwy 25 & Burnhamthorpe Road, 43°27'14"N, 79°47'32"W, 9-10 August 2003, S.M. Paiero. **Wentworth**, 1♂, Winona, 28 July 1948, G.G. Dustan (CNCI); 1♀, Ancaster, 8 August 1969, J.E.H. Martin (CNCI), 1♀, 9-15 July 1994, prairie, B. DeJonge. **Lincoln**, 3♀♀, Grimsby, 15 July 1955, D.H. Pengelly. **Brant**, 1♂, Ohsweken, 19 June 1979, D. Morris; 1♀, Paris, 24 June 1955, D.H. Pengelly; Brantford Railway Prairie, 43°10'N, 80°19'W, 1♀, 24 August 2001, yellow pans, 2♂♂, 12 July 2002, S.M. Paiero, 11♂♂ 2♀♀, 24 July 2002, M. Buck & S.M. Paiero. **Norfolk**, 1♀, Delhi-Simcoe Railway, 42°51'N, 80°23'W, 16 July 2002, S.M. Paiero; Manestart Tract, 1♀, 20-26 August 1993, oak savannah, malaise trap, J.T. Kerr, M. deGiusti & L. Packer (LPC), 19♀♀, 24 August-7 September 2001, 1♂ 4♀♀, 23 June 2002, sandy field, M. Buck & S.M. Paiero; 4♀♀, N limit of St. Williams Crown Forest, 42°43'4"N, 80°28'17"W, 29 August 2001, sandy road, M. Buck. **Middlesex**, Komoka Feed Mill Prairie, 42°58'N, 81°25'W, 1♂, 11 July 2001, sweeps, 1♀, 14-27 July 2001, yellow pans, S.M. Paiero. **Elgin**, 4♂♂ 1♀, Port Burwell, 4 July 1974, J.T. Huber. **Lambton**, 7♂♂, Walpole I., 11 July 1977 and 12 July 1979, K.N. Barber & W.A. Attwater. **Kent**, 1♂, Chatham, 26 July 1954, K.G. Davey (CNCI); 6♂♂ 2♀♀, Wheatley, 15 August 1982, T.D. Galloway (EDUM). **Essex**, 4♂♂ 4♀♀, Point Pelee, 20 and 28 July 1978, W.A. Attwater & D. Morris; Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 5♂♂ 6♀♀, 29-30 July 2003, M. Buck, 4♂♂ 3♀♀, 14-15 August 2003, yellow and white pans, M. Buck & D. Cheung; 1♀, Point Pelee

National Park, De Laurier House, 29-30 July 2003, yellow pans, M. Buck & D. Cheung; 32♂♂ 4♀♀, Leamington, various dates, 1975, 1977, 1983-85, 1987 (EDUM); 1♂, Seacliffe, 15 August 1983, T.D. Galloway (EDUM); 2♂♂ 7♀♀, Harrow, July-August, 1973-1976, R.E. Roughley, J.T. Huber & C.D. Neilsen; 1♀, Windsor, Ojibway Prairie, 19 June 2002, on earth between roots of fallen tree, M. Buck.

Distribution. Newly recorded for Ontario. Canada: QC (Finnamore 1982), BC; transcontinental in U.S.: MA to VA (incl. NY, PA, MI), west to WA, CA (Krombein 1979; Eighme 1989). Palaearctic Region (Eighme 1989).

Biology. Nests gregariously in sand (Krombein 1979).

Diodontus spiniferus (Mickel, 1916)

Ontario: **Thunder Bay**, 1♂ 1♀, Little Pic River at Hwy 17, 48°48'5"N, 86°37'47"W, 17 July 2002, sand cliff, M. Buck. **Rainy River**, 4♂♂, Rainy River, 5 July 1960 and 3 August 1960, S.M. Clark (CNCI). **Carleton**, Ottawa, 1♂, "138.", "*Passaloecus mandibularis* St. 11.7.85" probably from Guignard's collection, 3♀♀, 30 August 1914, F.W.L. Sladen (CNCI). **Simcoe**, Midland, 2♂♂, 8 June 1974, 1♂, 9 June 1974, 3♂♂, 14 July 1974, 1♂ 1♀, 5 August 1974, J.T. Huber.

Quebec: 3♂♂ 3♀♀, Kazabazua, 4 August 1913, F.W.L. Sladen (CNCI).

Distribution. Newly recorded for eastern Canada (ON, QC). Western Canada: AB; U.S.: MD, IA, MO, MN, NE, MT, CO, CA (Eighme 1989).

Biology. Unknown.

Species recognition. The male of this species has never been described. It differs from all other Ontario species of *Diodontus* by the combination of a yellow mandible and a black pronotal lobe.

Diodontus virginianus (Rohwer, 1917)

Ontario: **Halton**, 1♀, Oakville, nr. Hwy 25 & Burnhamthorpe Road, 43°27'14"N, 79°47'32"W, 9 August 2002, S.M. Paiero. **Wentworth**, 3♀♀, Hamilton, 9-13 July 1981, M. Sanborne (CNCI); 2♀♀, nr. Carluke, 12-20 July 1996, wood pile, tepee trap, B. DeJonge. **Welland**, 1♀, Niagara Falls, Niagara Whirlpool, 1 July 2004, S.M. Paiero. **Norfolk**, 1♀, Delhi-Simcoe railway line, Simcoe Junction, 1-14 August 1994, J.T. Kerr & L. Packer (LPC); Manestar Tract, 42°43'N, 80°27'W, 2♀♀, 15-22 June 1992 (LPC, DEBU), 1♀, 27-30 June 1992, 1♀, 30 June-10 July 1992, 1♀, 10-18 July 1992, 2♀♀, 18-30 July 1992, oak savannah, malaise trap, P.J. Carson (LPC). **Elgin**, 1♀, Aylmer West, 13-17 July 1972, malaise trap, no collector (CNCI). **Essex**, 15♂♂ 27♀♀*), Windsor, Ojibway Prairie, 18-19 June 2002, females nesting in earth between roots of fallen tree, M. Buck & S.M. Paiero.

Distribution. Newly recorded for Canada. U.S.: VA, DC, MD, NY, OR, ID, CA (Eighme 1989).

Biology. Nests gregariously in flat soil or pockets of earth between roots, and provisions with Aphidae (Krombein 1979) and Adelgidae (see below). At Windsor, females of the cleptoparasitic fly *Leucophora sociata* (Meigen) (Anthomyiidae) were seen perching near and entering the *Diodontus* nests.

Prey records. *) Five unidentified Adelgidae.

Species recognition. See notes under *D. flavitarsis* and *D. adamsi*.

Pemphredon morio vander Linden, 1829

Ontario: **Norfolk**, 1♀, Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 8 June 2001, exiting from insect boring in old log, M. Buck.

Distribution. Newly recorded for the Nearctic Region. Widespread in Palaearctic: Europe (except Mediterranean), Turkey, Kazakhstan, Russia, Japan (Dollfuss 1995). Apparently a recent introduction.

Biology. Nests in dead wood. Prey are wingless Aphididae (Lomholdt 1975-76).

***Passaloecus borealis* Dahlbom, 1844**

Ontario: Thunder Bay, 1 ♀, Prairie River at Hwy 17, 38 km E Terrace Bay, 48°48'4"N, 86°47'4"W, 15-19 July 2002, boggy spruce, malaise trap, M. Buck.

Quebec: James Bay Route km 66, 1 ♀, 4-12 June 1987, flight intercept trap, 2 ♀ ♀, 12 June-8 August 1987, malaise/flight intercept trap, L. Leblanc (CNCI, DEBU).

Distribution. Newly recorded for the eastern Nearctic (ON, QC). Canada: BC, NT (Vincent 1978), YT (Finnamore 1997); western U.S.: WA and MT south to UT, CO, NM (Vincent 1978).

Biology. Unknown. Other species of the genus nest in pithy plant stems, in borings in wood or abandoned galls, and prey on Aphididae and Lachnidae (Lomholdt 1975-76).

***Passaloecus gracilis* (Curtis, 1834)**

Ontario: Carleton, 5 ♀ ♀, Ottawa, 1, 5, 10 and 14 August 1989, damp second-growth *Acer-Betula* wood, J.R. Vockeroth (CNCI); 5 ♀ ♀, Metcalfe, 28 July 1993, B.E. Cooper (CNCI). **Grey**, 2 ♂ ♂ 1 ♀, Flesherton, Saugeen River, 2001, reared from trap nest, P.E. Hallett. **Wellington**, Guelph, 1 ♂, 10 June 1975, W.A. Attwater, 3 ♀ ♀, 26 June 1979, D.C. Murrell, 2 ♂ ♂, 28-29 June 1982, K.N. Barber. **Waterloo**, Cambridge, 1 ♀, 4 August 1981, C. Bolter, 1 ♀, 7 June 1984, grass field, M. Harvey. **Halton**, Milton, Derry Road & 4th Line, 43°31'31"N, 79°50'25"W, 1 ♂, 28 June 2002, 1 ♂, 19 June 2003, 1 ♀, 3 September 2003, S.M. Paiero; 1 ♂ 1 ♀, Oakville, 13 June 1976, W.A. Attwater; 1 ♀, Oakville, nr. Hwy 25 & Burnhamthorpe Road, 43°27'14"N, 79°47'32"W, 9-10 August 2003, S.M. Paiero. **Wentworth**, 1 ♀, Ancaster, 43°13'N, 79°59'W, 1-9 July 1994, prairie, B. DeJonge. **Welland**, 1 ♀, Fonthill, 7 August 1984, M.A. Luciani. **Norfolk**, 1 ♀, Manestar Tract, 42°43'N, 80°27'W, 20-26 August 1993, oak savannah, malaise trap, J.T. Kerr, M. deGiusti & L. Packer (LPC). **Elgin**, 1 ♀, St. Thomas, 26 June 1983, R.D. Smith. **Essex**, 1 ♂, Leamington, 7 August 1985, T.D. Galloway (EDUM).

Alberta: 1 ♀, Calgary, University Farm, 12 July 1988, L. Packer (LPC).

Distribution. Newly recorded for Ontario and Alberta. Canada: QC (Finnamore 1982); eastern U.S.: NJ, PA, OH, MI to TX along coast, IN (Krombein 1979). A western European species, probably introduced to the New World (Krombein 1979).

Biology. Nests in dry plant stems (e.g., *Phragmites*, *Sambucus*), in insect borings in dead wood, and cynipid galls on *Quercus*. Prey consists of Lachnidae and Aphididae (Lomholdt 1975-76).

Species recognition. The pale markings of this species are far more variable than indicated by Vincent (1978). Some of the examined specimens (males and females) have entirely black or dark brown mandibles, palpi, scapes, tibiae and pronotal lobes.

***Spilomena amplexipes* Krombein, 1952**

Ontario: Muskoka, 1 ♀, Arrowhead Provincial Park, 15-17 September 1975, sweeping in seepage area, I.M. Smith (CNCI).

New Brunswick: 1 ♀, Kouchibouguac National Park, 11 July 1977, M. Ivanochko (CNCI).

Distribution. Newly recorded for Canada (ON, NB). U.S.: MN, WV (Bohart and Smith 1994).

Biology. Presumably nests in old beetle borings in dead wood (Krombein 1979).

Spilomena pusilla (Say, 1837)

Ontario: Simcoe, 1 ♂, Penetang, 1 August 1955, J.G. Chillcott (CNCI). Halton, 1 ♀, Oakville, nr. Hwy 25 & Burnhamthorpe Road, 43°27'14"N, 79°47'32"W, 9 August 2002, S.M. Paiero.

Distribution. Newly recorded for Canada. U.S.: NY (Kurczewski and Miller 1991), CT to NC (incl. NY, PA), west to CA, AZ (Bohart and Smith 1994).

Biology. Nests in abandoned burrows of Anobiidae in dead wood. Prey are larval and adult Thysanoptera (Krombein 1979).

Ammoplanus (Ammoplanellus) lenape lenape (Pate, 1937)

Ontario: Manitoulin, 2 ♀ ♀, Barrie I., 45°55'N, 83°37'W, 1 July 1993, alvar, screen sweep, H. Goulet (CNCI).

Distribution. Genus and species newly recorded for Canada. Nominate subspecies otherwise known from type locality only (PA: Northampton County). Subspecies *olamentke* (Pate 1943) from MT, CA (Krombein 1979).

Biology. Species of the nominate subgenus are believed to nest in pre-existing holes or crannies in wood and possibly provision their cells with Thysanoptera (Krombein 1979).

Species recognition. This is one of only two described eastern Nearctic species within the predominantly western tribe Ammoplanini. Identification of these tiny and cryptic wasps remains tentative until the eastern Nearctic fauna is better known.

Subfamily Astatinae

Diploplectron peglowi Krombein, 1939

Ontario: Manitoulin, 2 ♀ ♀, Manitoulin I., south shore nr. Poplar, 18 August 1982, M. Sharkey (CNCI); Manitoulin I., Carter Bay, 45°36'23"N, 82°8'27"W, 3 ♂ ♂ 1 ♀, 24 June 2003, 3 ♂ ♂, 27 June 2003, 4 ♂ ♂ 3 ♀ ♀*, 13 July 2003, M. Buck; Manitoulin I., Sand Bay, 45°48'6"N, 82°47'36"W, 1 ♂, 25 June 2003, 1 ♀, 17 July 2003, M. Buck; 2 ♀ ♀, Manitoulin I., Misery Bay Provincial Park, 45°47'37"N, 82°44'11"W, beach, 12 July 2003, M. Buck; 12 ♂ ♂ 3 ♀ ♀, Manitoulin I., Union Road nr. Portage Lake, 45°46'5"N, 82°32'13"W, sandy field, 14 July 2003, M. Buck; 1 ♂, Manitoulin I., Portage Bay, 45°45'N, 82°32'W, dunes, 21 July 2003, M. Buck. Carleton, 1 ♀, Ottawa, 25 August 1954, W.R.M. Mason (CNCI); 1 ♂, Ottawa, Bruce Pit, 11-17 July 2000, yellow pans, L. Masner (CNCI). Bruce, Dorcas Bay, 45°11'N, 81°35'W, 1 ♀, 19-24 August 1997, 2 ♀ ♀, 5-13 June 1999, 1 ♂ 4 ♀ ♀, 30 June-21 July 2003, sand dune, malaise trap, S.A. Marshall; 5 ♂ ♂, Bruce Peninsula National Park, Singing Sands, 45°11'34"N, 81°34'58"W, dunes, 8 July 2003, M. Buck; Inverhuron Provincial Park, 2 ♂ ♂, 2 July 2003, M. Buck, 1 ♀, 28 June-8 July 2003, 2 ♀ ♀, 8-20 July 2003, malaise trap, S.A. Marshall. Grey, 1 ♀, Hepworth dunes, 44°37'N, 81°9'W, 5 July 2003, M. Buck. Norfolk, 1 ♀, Walsingham, Regional Road 60 5.5 km W Jct. Hwys 24 & 59, Pteraphylla Farm, 19 August 1991, P.J. Carson (LPC); Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 1 ♂ 8 ♀ ♀, 24 August 2001, 3 ♂ ♂ 1 ♀, 29 August 2001, 2 ♂ ♂ 1 ♀, 7 September 2001, 1 ♂ 3 ♀ ♀, 23 June 2002, sandy field, M. Buck. Lambton, 1 ♀, Pinery Provincial Park, 1-30 June 1986, malaise trap, L. Packer (ROME); 1 ♀, Pinery Provincial Park, powerline, 18-21 June 1986, malaise trap, L. Packer (LPC). Essex, 1 ♀, Point Pelee, 21 June 1920 (CNCI).

Saskatchewan: 1 ♀, Great Sand Hills, 50°42'N, 109°17'W, 16-19 June 1988, W. Polak (CNCI).

Distribution. Newly recorded for Ontario and Saskatchewan. Western Canada: YT (Finnamore 1997), NT; western U.S.: WY, ID, CO, UT, NV, CA (Krombein 1979). Rare in east: NY (Oswego County), MI (Alger, Kalkaska, Livingston and Marquette Counties) (O'Brien 1984).

Biology. Nests in sand. Prey are nymphs of various species of the families Lygaeidae (s.l.) and Rhopalidae (Krombein 1979).

Prey record. *) One nymphal Rhyparochromidae (Lygaeidae, s.l.), probably *Emblethis vicarius* Horváth.

Astata nubecula Cresson, 1865

Ontario: Manitoulin, 2♂♂, Gore Bay, 16 July 1960, D.H. Pengelly. **Bruce,** 1♂, Dyers Bay, 8 July 1953, D.H. Pengelly; 1♀, Crane River Road, 29 July 1997, S.A. Marshall. **Norfolk,** 1♀*), Turkey Point Provincial Park, east boundary, 42°42'37"N, 80°19'47"W, 17 August 2003, M. Buck. **Essex,** 1♀, Windsor, Ojibway Prairie, 30-31 July 2002, S.M. Paiero.

British Columbia: 2♂♂, Penticton, 1 August 1974, B.K. Akey.

Distribution. Newly recorded for Ontario and British Columbia. Canada: AB (Strickland 1947), QC (Finnamore 1982), NT; western and northern U.S. south to VA (Krombein 1979).

Biology. Nests in hard, bare, stony soil or in sand. Prey are nymphs of various Pentatomidae (Krombein 1979).

Prey record. *) One nymphal *Dendrocoris humeralis* (Uhler) (Pentatomidae).

Astata occidentalis Cresson, 1881

Ontario: Halton, Milton, Woodland Trails Camp, 4th Line Nassagaweya, 43°32'51"N, 79°59'35"W, 2♀♀), 15 August 2002, S.M. Paiero, 9♀♀²), 18 August 2003, M. Buck; 1♀, Oakville, nr. Hwy 25 & Burnhamthorpe Road, 43°27'14"N, 79°47'32"W, 30 August 2003, S.M. Paiero. **Norfolk,** 1♀, Normandale Fish Culture Station, 42°43'7"N, 80°20'20"W, 23 August 2003, B. Arnal & H. Duggan (BAR). **Middlesex,** 1♀, London, 5 July 1990, R.W. Turmock (EDUM).

Distribution. Newly recorded for Ontario. Recorded by Parker (1962) from the "southern provinces of Canada" without mentioning a province in particular; entire U.S.; Mexico south to Michoacán and Baja California Sur (Parker 1962). Besides the specimens from Ontario no other Canadian material was found in collections.

Biology. Nests in bare, hard-packed clay and provisions with Pentatomidae of various genera (Krombein 1979).

Prey records. ¹) One adult *Banasa dimidiata* (Say) (Pentatomidae). ²) Five adult *Banasa dimidiata*, two adult *Elasmotethus cruciatus* (Say) (Acanthosomatidae). Several females were observed nesting in a small area of hard-packed soil on an abandoned unpaved road.

Subfamily Crabroninae (syn.: Larrinae)

Liris beatus (Cameron, 1889)

Ontario: Lambton, 2♀♀, Pinery Provincial Park, powerline, 15 July 1986, L. Packer (LPC, DEBU).

Distribution. Newly recorded for Canada. Transcontinental in U.S.: NY to TX, and WY, UT south to CA, NM (Krombein and Shanks Gingras 1984); Panama (Krombein 1979).

Biology. Preys on nymphs and adults of *Gryllus* species and *Acheta domesticus* L. (Gryllidae) (Krombein and Shanks Gingras 1984).

Tachytes crassus Patton, 1881

Ontario: Kent, 8♂♂, Rondeau Provincial Park, 14 July 1962, S.M. Clark (CNCT); 2♀♀*), Rondeau Provincial Park, Spicebush Trail, 42°18'9"N, 81°51'6"W, 15 August 2003, Carolinian forest, S.M. Paiero; Rondeau Provincial Park, South Point Trail, east parking lot, 42°15'42"N, 81°50'49"W, 3♀♀, 9-10 August 2003, oak savannah, nesting in sand below roots of fallen tree,

M. Buck, 1♂, 16 August 2003, dunes, S.M. Paiero; 3♂♂ 1♀, Rondeau Provincial Park, Lakeshore Road, Beach Access #11, 42°16'1"N, 81°50'39"W, 10 August 2003, dunes, M. Buck; 1♀, Wheatley, 9 July 1977, K.N. Barber. **Essex**, 1♀, Point Pelee, 30 July 1920, N.K. Bigelow (ROME); 1♂, Seaccliffe, 1 August 1975, T.D. Galloway (EDUM); 1♂, Ojibway Prairie Reserve, 12 July 1982, K.N. Barber; 1♂, Ojibway Park, 1 August 1984, M.T. Kasserra.

Distribution. Newly recorded for Canada. Eastern U.S. (incl. NY, WI) to eastern TX, NE (Bohart 1994).

Biology. Nests in sand or in heavy clay-loam. Prey are nymphs and sometimes adults of *Orchelimum* and *Conocephalus* (Tettigoniidae) (Krombein 1979).

Prey record. *) One adult female *Conocephalus nigropleurum* (Bruner).

Tachytes harpax Patton, 1881

Ontario: Nipissing, 1♂ 2♀♀, Algonquin Provincial Park, Lake Travers Road NE km 36.5, 45°54'1"N, 77°42'45"W, 18-19 August 2002 (1♀ in yellow pans), M. Buck. **Bruce**, 1♂, Inverhuron Provincial Park, front dunes, 44°17'33"N, 81°35'28"W, 22 August 2003, yellow pans, M. Buck. **Peel**, 1♀, Caledon East, 7 July 1989, woodlot clearing, L. Packer (LPC). **Wellington**, Guelph, 1♀, 21 July 1977, K.N. Barber, 1♀, 11 August 1977, D.C. Murrell, 1♂, 28 July 1978, M.L.B. Farrell, 1♀, 31 July 1978, B. Warner. **Halton**, 1♀, Burns Conservation Area, 20 July 1980, J. Kircher. **Essex**, 1♀, Windsor, Ojibway Prairie, nr. Sprucewood Avenue, 26-27 August 2002, yellow pans, M. Buck & S.M. Paiero.

Distribution. Newly recorded for Canada. Eastern U.S. (incl. PA, MI, WI): MA to FL, IL and eastern TX (Bohart 1994; Krombein 1979).

Biology. Nests in fine silt and sand. Prey is *Conocephalus brevipennis* (Scudder) (Tettigoniidae) (Krombein 1979).

Tachytes intermedius (Viereck, 1906)

Ontario: Peterborough, 1♂, Norwood, 5 July 1977, T.D. Galloway (EDUM). **Lambton**, 1♀, Pinery Provincial Park, 5 August 1986, malaise trap, L. Packer (LPC). **Kent**, 3♀♀, Rondeau Provincial Park, South Point Trail, east parking lot, 42°15'42"N, 81°50'49"W, 9-10 August 2003, dunes, yellow and white pans, M. Buck; 1♂, Rondeau Provincial Park, South Point Trail East, 42°15'35"N, 81°50'53"W, 9-10 August 2003, savannah, white pans, M. Buck. **Essex**, Windsor, Ojibway Prairie, 1♀, 30-31 July 2002, 1♀, 26-27 August 2002, S.M. Paiero, 1♂ 2♀♀, 27 August 2002, 1♂ 2♀♀*, 13 September 2002, M. Buck.

Distribution. Newly recorded for Canada. Eastern U.S.: NY to FL, west to NE, TX (Krombein 1979).

Biology. Nests in sand and preys on nymphs and adults of *Neotridactylus apicalis* (Say) and *Ellipes minutus* Scudder (Tridactylidae) (Kurczewski and Kurczewski 1971).

Prey record. *) One nymphal *Ellipes minutus* Scudder.

Tachytes pennsylvanicus Banks, 1921

Ontario: Wellington, Guelph, 2♂♂, 14 August 1974, P.G. Mason (1♂ deposited in CASC). **Locality unknown:** 1♀, "E Ont. Can", no date/collector (CNCI); 1♀, "32" and "Ont. Evans", no date (CNCI).

Distribution. Newly recorded for Ontario. Canada: QC (Finnamore 1982); eastern U.S. (incl. NY) west to MT, NE and TX (Bohart 1994). Apparently, older records from further west (BC; OR, ID, CO, NM; see Krombein 1979) are due to misidentifications.

Biology. Species of the *pepticus* species group of *Tachytes* to which this species belongs are ground-nesting and prey on Acrididae (Krombein 1979).

***Tachysphex alpestris* Rohwer, 1908**

Ontario: Thunder Bay, 1♀, Mouth of Pic River, N side, 48°36'N, 86°18'W, 19 July 2001, sandy area, M. Buck; 11♂♂ 8♀♀, same data except 20 July 2001, sand dunes (1♂ 1♀ deposited in CASC, 1♂ in CNCI); same data except 19-22 July 2001, 1♀, malaise trap, 2♂♂ 1♀, yellow pans, sand dunes, M. & B. Buck; 1♀, Pukaskwa National Park, Beach Trail, 29 July 2003, dunes, S.M. Paiero; 8♂♂ 3♀♀, Neys Provincial Park, Dune Trail, 48°46'52"N, 86°36'53"W, 7 July 2002, M. Buck; 6♂♂ 5♀♀, Neys Provincial Park, Prisoner's Cove nr. Little Pic River, 48°47'28"N, 86°37'48"W, 16 and 18 July 2002, beach, M. Buck; 2♂♂, Neys Provincial Park, railway crossing, 48°46'30"N, 86°35'3"W, 17 July 2002, M. Buck; 1♂ 1♀, Terrace Bay, beach of Lake Superior, 48°46'19"N, 87°7'3"W, 15 July 2002, M. Buck; 1♀, Terrace Bay, 48°46'39"N, 87°6'29"W, 15 July 2002, sandy forest edge, M. Buck; 1♂, 28 km E Nipigon, 48°58'0"N, 87°58'47"W, 8 July 2002, M. Buck; 7♂♂, 8♀♀, Sleeping Giant Provincial Park, 2.5 km S Visitor Centre, 48°20'53"N, 88°48'11"W, 9 and 14 July 2002, old sand pit, M. Buck. **Manitoulin**, 4♀♀, Manitoulin I., Carter Bay, 45°36'23"N, 82°8'27"W, 23-24 June 2003, dunes, M. Buck & S.M. Paiero, 1♂, 13 July 2003, M. Buck.

The following specimens show characters intermediate with regard to *Tachysphex terminatus* (see note below): 2♂♂, Manitoulin I., Carter Bay, 45°36'23"N, 82°8'27"W, 13 July 2003, dunes, M. Buck; 5♂♂, Manitoulin I., Union Road nr. Portage Lk., 45°46'5"N, 82°32'13"W, 14 July 2003, sandy field, M. Buck.

Distribution. Newly recorded for the eastern Nearctic. Western Canada: YT (Finnamore 1997), NT, BC to MB; AK, western U.S. east to MT, NE, NM; Mexico: along Pacific and Gulf Coast south to Yucatan and Chiapas; Costa Rica (Limón) (Pulawski 1988).

Biology. Nests in the ground. Prey are immature Acrididae (Pulawski 1988).

Taxonomy. Pulawski (1988) indicated that this 'species' might just be a geographical race of *T. terminatus*. The two taxa are almost completely allopatric but Pulawski (l.c.) mentions seven localities in Canada, the U.S. and Mexico where both occur together. In Ontario *T. alpestris* is restricted to the north ranging south to Manitoulin I. (see specimen data) while *T. terminatus* is widespread in the south reaching Manitoulin I. in the north. On Manitoulin I. the two species appear to intergrade: The population from Carter Bay shows more similarity with *T. alpestris* (metapleural process small, apical metasomal segments of male black) but some specimens possess a relatively large metapleural process. In the population from Union Road most specimens resemble *T. terminatus* (metapleural process larger, apical metasomal segments of male red) but some specimens possess a fairly small metapleural process and the metasoma of some males is completely black (this colour form rarely occurs in *terminatus*, cf. Pulawski 1988; I have not seen it yet from Ontario). At neither of the two sites typical specimens of both *T. alpestris* and *T. terminatus* occur together, only typical specimens of one taxon and intermediate forms. The morphological extremes from each site are linked through intermediate forms and do not appear to be representative of different species. This could also be true for populations from other putative sympatric localities. These observations further support the hypothesis that *T. alpestris* is merely a subspecies of *T. terminatus*.

***Tachysphex antennatus* Fox, 1894**

Ontario: York, 1♂, King Township, Joker's Hill, Koffler Scientific Reserve, 44°3'N, 79°29'W, late August 2003, W. Godsoe. **Peel**, Forks of the Credit, 1♀, 17 June 1965, 1♂, 15 July 1965, G. Knerer (ROME), 1♂, 5 August 1969, 1♀, 26 August 1969, P. MacKay (ROME), 1♂, June 1981, L. Packer (LPC); 29♂♂ 31♀♀*, Forks of the Credit Provincial Park, 3 August 2002, M. Buck; Forks of the Credit, gravel pit NW of Provincial Park, 43°49'24"N, 80°0'57"W, 5 August 2002 1♂ 2♀♀, white pans, 3♂♂, M. Buck. **Wellington**, 1♂, Arkell, 22 July 1960, D.H. Pengelly;

Guelph, 1♀, 12 July 1978, B. Warner, 1♂, 8 August 1978, W.A. Attwater. **Halton**, 1♂ 2♀♀, Milton, Woodland Trails Camp, 4th Line Nassagaweya, 43°32'51"N, 79°59'35"W, 18 August 2003, M. Buck & S.M. Paiero. **Wentworth**, 1♂, Ancaster, 8 August 1969, J.E.H. Martin (CNCI); 25♂♂ 6♀♀ (10♂♂ 2♀♀ in yellow and white pans), Flamborough, Lawson Farm, 43°18'58"N, 80°2'26"W, 30 June-1 July 2003, alvar, M. Buck. **Brant**, Brantford Railway Prairie, 43°10'N, 80°19'W, 1♂, 24 August 2001, 6♂♂ 1♀, 12 July 2002, yellow pans, S.M. Paiero. **Norfolk**, 1♂, Turkey Point Tract at Regional Road 10, 42°42'2"N, 80°20'17"W, 23 August 2003, M. Buck. **Middlesex**, 1♂ 1♀, Komoka Feed Mill Prairie, 42°58'N, 81°25'W, 11-14 July 2001, yellow pans, S.M. Paiero. **Essex**, Windsor, Ojibway Prairie, 1♀, 26 August 2002, 1♂, 13 September 2002, M. Buck.

Distribution. Newly recorded for eastern Canada. Canada: southern BC; transcontinental in U.S.: NH and FL (incl. NY, PA, OH, MI) to OR and CA; Mexico south to Chiapas (Pulawski 1988).

Biology. Unlike most other members of the genus in Ontario this species nests in hard-packed soil. Prey are nymphal *Melanoplus* (Acrididae) (Pulawski 1988).

Prey record. *) One third-instar *Chorthippus curtipennis* (Harris) (Acrididae).

Tachysphex apicalis Fox, 1893

Ontario: **Essex**, 1♀, Windsor, Springarden Road ANSI, 31 July 2002, M. Buck.

Distribution. Newly recorded for Ontario. Canada: AB, BC; transcontinental in U.S. (incl. NY, MI, WI); most of Mexico south to Isthmus of Tehuantepec; Cuba; introduced to Hawaii (Pulawski 1988).

Biology. This species differs from most other *Tachysphex* by building its nest in sloping banks or cliffs, vertical parts of land tortoise holes, or even mortar between foundation rocks of a house. Prey are immature grasshoppers of various genera (Pulawski 1988).

Tachysphex texanus (Cresson, 1872)

Ontario: **Carleton**, 1♂, Ottawa, Innes Point, 10 July 1985, pan trap, L. Masner (CNCI).

Dufferin, 1♂, Primrose, 17 July 1956, D.H. Pengelly. **Wellington**, 1♂, Eramosa, 25 July 1959, R.E. Crawford; 1♂, Arkell, 22 July 1960, D.H. Pengelly.

Distribution. Newly recorded for eastern Canada. Canada: southern AB; transcontinental in U.S.: MA and FL (incl. MI) to WA and CA; Mexico south to Jalisco (Pulawski 1988).

Biology. This species is ground-nesting and preys on immature Acrididae (Pulawski 1988).

Plenoculus davisi davisi Fox, 1893

Ontario: **Thunder Bay**, 1♂, Thunder Bay, 13 km ENE Jct. Hwy 17 & 527, 48°31'37"N, 88°58'41"W, 10 July 2002, M. Buck; 4♂♂, same except 16 km ENE Jct. Hwy 17 & 527, 48°32'7"N, 88°56'23"W. **Sudbury**, 1♀, Massey, 20 July 2002, sandy railway embankment, M. Buck. **Parry Sound**, 1♀, Powassan, 11 July 1978, J. Cappleman. **Manitoulin**, 1♂ 1♀, Manitoulin I., Carter Bay, 45°36'23"N, 82°8'27"W, 24 June 2003, dunes, M. Buck; 1♀, Manitoulin I., Misery Bay Provincial Park, 45°47'37"N, 82°44'11"W, 12 July 2003, beach, M. Buck; 5♂♂ 3♀♀, Manitoulin I., Union Road nr. Portage Lk., 45°46'5"N, 82°32'13"W, 14 July 2003, sandy field, M. Buck. **Carleton**, 2♀♀, Ottawa, 25 August 1954, W.R.M. Mason (CNCI); 1♂, Nepean, Slack Road [?], 10-15 August 1992, pan trap, L. Masner (CNCI). **Peterborough**, Norwood, 1♀, 23 July 1975, 2♂♂ 2♀♀, 5-6 August 1983, 5♀♀, 16 August 1984, T.D. Galloway (EDUM); 1♂, Serpent Mound Provincial Park, 8 August 1983, T.D. Galloway (EDUM). **Northumberland**, Brighton, 1♀, 17 July 1956, 1♂, 3 August 1956, malaise trap, no collector (CNCI); 1♀, Murray Township,

Murray Sand Hills, 28 July 1996, F.E. Kurczewski (FEK). **Bruce**, Inverhuron Provincial Park, front dunes, 44°17'33"N, 81°35'28"W, 2♀, 22 August 2003, yellow pans, 1♀, 2 July 2003, M. Buck. **Bruce or Grey**, 1♂, Hepworth, 26 June 1975, J.T. Huber. **Grey**, 2♂♂, Meaford, 14 June 1975, J.T. Huber; Hepworth dunes, 44°37'N, 81°9'W, 1♂ 1♀, 5 July 2003, 1♂, 22 July 2003, M. Buck. **Simcoe**, Midland, 1♀, 6 July 1974, 1♀, 14 July 1974, 1♂ 3♀, 26 August 1974, J.T. Huber; 1♀, C.F.B. Borden, 27 July 1996, F.E. Kurczewski (FEK). **Dufferin**, Primrose, 4♀, 30 June 1955, 1♂ 2♀, 17 July 1956, D.H. Pengelly; 1♀, same except 6 July 1974, J.T. Huber. **York**, 1♂, King Township, Joker's Hill, Koffler Scientific Reserve, 44°3'N, 79°29'W, 6 July 2003, W. Godsoe. **Peel**, Forks of the Credit, gravel pit NW of Provincial Park, 43°49'24"N, 80°0'57"W, 8♂♂ 2♀♀), 3 August 2002, 4♂♂, 5 August 2002, M. Buck. **Wellington**, 1♂, Guelph, 27 July 1974, J.T. Huber; 2♂♂, Aberfoyle, 25 June 1956, D.H. Pengelly. **Halton**, 1♂ 1♀, Aldershot, 7 July 1955, L.A. Kelton (CNCI). **Wentworth**, 1♀, Ancaster, 18-25 June 1994, prairie, malaise trap, B. DeJonge. **Norfolk**, Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 3♂♂ 1♀, 2 July 2000, 1♀, 8 July 2000, 3♂♂, 8 June 2001, 18♂♂, 15 June 2001, 3♂♂ 2♀♀, 25 June 2001, 2♀♀, 3 August 2001, 2♀♀, 24 August 2001, 4♂♂, 23 June 2002, sandy field, M. Buck; 2♀♀, Delhi-Simcoe Railway, 42°51'N, 80°23'W, 16 July 2002, S.M. Paiero. **Middlesex**, Strathroy, 2♂♂, June 1922, A.A. Wood (CNCI), 1♂, 3 July 1914, H.F. Hudson (CNCI). **Essex**, 1♀, Point Pelee, 19 July 1978, J.M. Cumming; Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 7♂♂, 29-30 July 2003, 1♂, 14 August 2003, M. Buck, 1♂ 2♀♀, 14-15 August 2003, yellow and white pans, M. Buck & D. Cheung; 12♂♂ 5♀♀, Leamington, various dates, 1975, 1984-85, 1987, T.D. Galloway (EDUM); 2♂♂, Seacliffe, 1 August 1975, T.D. Galloway (EDUM); 3♂♂ 1♀, Windsor, Springarden Road ANSI, 31 July 2002, M. Buck.

Distribution. Newly recorded for Ontario. Canada: BC; U.S.: CT to FL, west to AK, ID, CA; Mexico (Krombein 1979). Finnamore (1982) recorded ssp. *atlanticus* Viereck from QC.

Biology. Nests in sand. Prey are nymphs and more commonly adults of various Miridae, *Arhyssus lateralis* (Say) (Rhopalidae) and immature Aphidae (Krombein, 1979).

Prey record. *) One adult male *Adelphocoris* cf. *lineolatus* (Goeze) (Miridae).

Solierella levis Williams, 1950

Ontario: **Peel**, Forks of the Credit, gravel pit NW of Provincial Park, 43°49'24"N, 80°0'57"W, 2♂♂ 1♀, 3 August 2002, 5♂♂ 1♀, 5 August 2002, along gravel road, M. Buck. **Essex**, 2♀♀, Leamington, 18 August 1987, T.D. Galloway (EDUM).

Distribution. Newly recorded for Canada. U.S.: CA (Krombein 1979). CASC has specimens from CA, AZ, NV, UT, western TX (Pulawski, *in litt.*).

Biology. Unknown. Specimens from Forks of the Credit were collected along an abandoned gravel road at the edge of an active gravel pit. Unlike *S. peckhami* and *S. plenoculoides* adults are not attracted by white or yellow pans.

Taxonomy. The Ontario specimens were thoroughly compared to specimens from California (material in CASC, USNM). Males differ consistently from California males by their less pointed clypeus. In both sexes the colour of the mandibles is darker than in California specimens. Otherwise eastern and western specimens are practically inseparable, including male genitalic characters (one male each examined from Forks of the Credit, ON, and Thousand Palms Canyon, Riverside County, CA, the latter in USNM).

Solierella peckhami (Ashmead, 1897)

Ontario: **Thunder Bay**, 1♂, Mouth of Pic River, N side, 48°36'N, 86°18'W, 19-22 July 2001, sand dunes, yellow pans, M. & B. Buck; 1♂, Terrace Bay, 48°46'39"N, 87°6'29"W, 15 July 2002, sandy forest edge, M. Buck. **Sudbury**, 1♂, Nairn Centre, Old Nairn Road nr. Hwy 17,

46°19'35"N, 81°37'6"W, 6 July 2002, M. Buck. **Manitoulin**, 1♂, Manitoulin I., Carter Bay, 45°36'23"N, 82°8'27"W, dunes, 24 June 2003, M. Buck. **Carleton**, 1♀, Ottawa, Innes Point, 10 July 1985, pan trap, L. Masner (CNCI); 7 km SW Carleton Place, 1♂, 20-26 May 1981, 2♂♂ 2♀♀, 19-29 June 1981, S.J. Miller (CNCI). **Leeds and Grenville**, St. Lawrence Is. National Park, Grenadier I. Centre, 1♂, 4 June 1975, pan trap, 1♀, 1 August 1975, E. Sigler (CNCI). **Hastings**, 1♀, Marmora, 8 September 1952, J.F. McAlpine (CNCI); 1♀, Chatterton, 15 June 1953, J.C. Martin (CNCI); Belleville, 1♂, 16 July 1949, 1♀, 2 September 1950, J.C. Martin (CNCI). **Northumberland**, 1♀, Brighton, 13 July 1956, no collector, malaise trap (CNCI). **Bruce**, Inverhuron Provincial Park, front dunes, 44°17'33"N, 81°35'28"W, 1♂, 2 July 2003, netted, 2♀♀, 26 July 2003, white and yellow pans, 2♀♀, 22 August 2003, white and yellow pans, M. Buck. **York**, 1♀, King Township, Joker's Hill, Koffler Scientific Reserve, 44°3'N, 79°29'W, 18-19 August 2003, sand pit, yellow pans, W. Godsoe. **Peel**, 1♀, Forks of the Credit Provincial Park, 3 August 2002, white pans, M. Buck; 3♂♂ 4♀♀, Forks of the Credit, gravel pit NW of Provincial Park, 43°49'24"N, 80°0'57"W, 3 and 5 August 2002, yellow and white pans (except 2♀♀) M. Buck. **Wellington**, Guelph, 1♂, 12 July 1953, 1♀, 31 June 1955, D.H. Pengelly. **Waterloo**, 1♀, Cambridge, 21 June 1984, forest, M. Harvey. **Halton**, 2♂♂, Milton, Woodland Trails Camp, 4th Line Nassagaweya, 43°32'51"N, 79°59'35"W, 18 August 2003, M. Buck. **Wentworth**, 6♂♂ 4♀♀ (4♂♂ 3♀♀ in white and yellow pans), Flamborough, Lawson Farm, 43°18'58"N, 80°2'26"W, 30 June-1 July 2003, alvar, M. Buck. **Brant**, Brantford Railway Prairie, 43°10'N, 80°19'W, 2♂♂ 3♀♀, 12 July 2002, yellow pans, 1♂ 1♀, 24 July 2002, S.M. Paiero. **Norfolk**, 1♀, Nixon West Prairie, 28 May 1998, yellow pans, H. Douglas (LPC); Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 4♀♀, 25 July 2000, white pans, 1♀, 8 June 2001, yellow pans, 1♀, 15 June 2001, white pans, 3♀♀, 25 June 2001, white and yellow pans, 1♀, 3 August 2001, yellow pans, 2♀♀, 24 August 2001 white and yellow pans, 1♀, 7 September 2001, white pans, 2♂♂ 6♀♀, 23 June 2002, sandy field, Buck et al. **Kent**, Rondeau Provincial Park, South Point Trail East, 7♂♂ 1♀, 29 June 2002, netted, 1♂, 7 September 2002, yellow pans, M. Buck, 1♀, 16-17 June 2003, yellow pans, S.M. Paiero, 2♂♂ 2♀♀, 9-10 August 2003, white pans, M. Buck, 1♀, 5-7 September 2003, yellow pans, M. Buck. **Essex**, 1♂, Leamington, 4 August 1985, T.D. Galloway (EDUM); 1♂, Point Pelee National Park, West Beach, 29 July 2003, M. Buck; Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 1♂ 1♀, 29 July 2003, netted, M. Buck, 1♂ 1♀, 14-15 August 2003, yellow and white pans, M. Buck & D. Cheung; 1♂ 2♀♀, Point Pelee National Park, De Laurier House, 29-30 July 2003, white pans, M. Buck & D. Cheung; 3♀♀, Point Pelee National Park, Old Henry Camp, 41°57'35"N, 82°31'32"W, 14-15 August 2003, white pans, M. Buck & D. Cheung. **Locality unknown**, 1♀, "ex nursery in Ont.", no date/collector (CNCI).

Distribution. Newly recorded for Canada. Transcontinental in U.S.: NY to FL, west to ID, CA, introduced to Hawaii and Marshall Is. (Krombein 1979).

Biology. Nests in cavities in twigs and plant stems. Nymphal Lygaeidae (s.l.) are used as prey (Krombein 1979).

Solierella plenoculoides plenoculoides (Fox, 1893)

Ontario: Thunder Bay, 1♀, Pukaskwa National Park, Beach Trail, dunes, 29-30 July 2003, yellow pans, S.M. Paiero. **Carleton**, 1♂, Ottawa, 30 May 1914, F.W.L. Sladen (CNCI); 2♂♂, 7 km SW Carleton Place, 20-26 May 1981, S.J. Miller (CNCI). **Prince Edward**, 1♂ 2♀♀, Smith Bay nr. Picton, 1 July 1970, J.F. McAlpine (CNCI). **Bruce**, 1♀, Dyers Bay, 20 July 1955, D.H. Pengelly. **Grey**, 1♂, Meaford, 14 June 1975, J.T. Huber. **Welland**, 1♂, Wainfleet Bog 8 km S Welland, 7-13 June 1988, pan traps, A. Stirling. **Wentworth**, 1♂, Hamilton, 9-13 July 1981, M. Sanborne (CNCI). **Norfolk**, 1♂, Turkey Point Provincial Park, 1 June 2002, oak savannah, white

pans, M. Buck; Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 1♂, 8 July 2000, on logs, 1♂, 23 June 2002, M. Buck. **Kent**, Rondeau Provincial Park, South Point Trail East, 1♀, 28 June 2002, M. Buck, 1♂, 29 May 2003, white pans, M. Buck & S.M. Paiero, 1♀, 9-10 August 2003, white pans, M. Buck, 1♂, 13-15 August 2003, yellow pans, S.M. Paiero. **Essex**, 1♂ 1♀, Point Pelee National Park, De Laurier House, 29-30 July 2003, yellow and white pans, M. Buck & D. Cheung; 1♀, Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 14-15 August 2003, white pans, M. Buck & D. Cheung; Windsor, Ojibway Prairie, 1♂, 3-6 July 2001, 1♂, 10-13 July 2001, 2♀♀, 7-10 August 2001, 1♀, 21-24 August 2001, 1♀, 30 August-4 September 2001, 11♂♂ 2♀♀, 30 May 2002, yellow pans, S.M. Paiero, 4♂♂ 2♀♀, 18-19 June 2002, yellow pans (excl. 1♂ 1♀), M. Buck & S.M. Paiero, 2♂♂ 6♀♀, 30-31 July 2002, white and yellow pans (excl. 1♂ 2♀♀), Buck et al., 3♀♀, 26-27 August 2002, yellow pans, M. Buck, 1♂ 2♀♀, 25 July 2003, yellow pans, S.M. Paiero.

Distribution. Newly recorded for Canada. U.S.: NY (Kurczewski and Miller 1991), NH to VA, west to CO, TX, AZ (Krombein 1979).

Biology. Has been reported to nest in goldenrod galls caused by *Eurosta solidaginis* (Fitch) (Tephritidae) (Krombein 1979). The prey is unknown.

Miscophus americanus Fox, 1890

Ontario: Thunder Bay, 1♀, 28 km E Nipigon, 48°58'0"N, 87°58'47"W, 8 July 2002, M. Buck; 2♂♂, Terrace Bay, 15 July 2002, sandy forest edge, M. Buck. **Nipissing**, 1♂, Algonquin Provincial Park, Arowhon Road, Simm's Pit, 45°34'19"N, 78°42'41"W, 15-16 August 2002, yellow pans, M. Buck. **Parry Sound**, 1♂, Nobel Township N of Parry Sound, 3-4 August 2002, yellow pans, E.L. Westman. **Manitoulin**, Manitoulin I., Carter Bay, dunes, 45°36'23"N, 82°8'27"W, 5♂♂ 1♀, 24 June 2003, 2♂♂ 4♀♀¹), 13 July 2003, M. Buck; Manitoulin I., Providence Bay, dunes, 45°39'41"N, 82°15'40"W, 1♀, 26 June 2003, 2♂♂ 3♀♀, 18 July 2003, M. Buck; Manitoulin I., Sand Bay, dunes, 45°48'6"N, 82°47'36"W, 6♂♂ 2♀♀, 25 June 2003, M. Buck & S.M. Paiero, 1♂ 3♀♀, 17 July 2003, M. Buck; 6♂♂ 1♀, Manitoulin I., Shrigley Bay, 45°43'33"N, 82°29'5"W, 9 July 2003, dunes, M. Buck; 9♂♂, Manitoulin I., Misery Bay Provincial Park, 45°47'37"N, 82°44'11"W, 12 July 2003, beach, M. Buck; 4♂♂ 1♀, Manitoulin I., Union Road nr. Portage Lk., 45°46'5"N, 82°32'13"W, 14 July 2003, sandy field, M. Buck; 4♂♂, Manitoulin I., Dominion Bay, 45°42'19"N, 82°24'30"W, 16 July 2003, dunes, M. Buck; 2♂♂ 1♀, Manitoulin I., Square Bay, 45°42'N, 82°23'W, 19 July 2003, dunes, M. Buck; 1♂ 1♀, Manitoulin I., Portage Bay, 45°45'N, 82°32'W, 21 July 2003, dunes, M. Buck. **Carleton** 1♂, Ottawa, 25 August 1954, W.R.M. Mason (CNCI); 1♂, Ottawa, uplands sand pits, 25 August 1954, C.D. Miller (CNCI); 1♀, Ottawa Airport, 25 June-2 July 1985, pan trap, J. Denis (CNCI); 2♀♀, Merivale, 23 June 1953, C.D. Miller (CNCI). **Prince Edward**, 1♂ 1♀, Smith Bay nr. Picton, 1 July 1970, J.F. McAlpine (CNCI). **Peterborough**, Norwood, 1♀, 24 August 1982, 1♂ 2♀♀, 16 August 1984, T.D. Galloway (EDUM). **Northumberland**, 2♀♀, Brighton, 20 and 25 July 1956, malaise trap, no collector (CNCI). **Bruce**, Dorcas Bay dunes, 2♀♀, 19-24 August 1997, malaise trap, 1♀, 5-13 June 1999, malaise trap, 3♂♂, 5-19 June 1999, malaise pans, S.A. Marshall; Bruce Peninsula National Park, Singing Sands dunes, 45°11'34"N, 81°34'58"W, 1♂, 2 September 1997, malaise trap, S.A. Marshall, 7♂♂, 8 July 2003, M. Buck; 1♀, Lake Scugog, 45°7'N, 81°32'W, 1-17 August 2002, malaise trap, S.A. Marshall; Inverhuron Provincial Park, 49♂♂ 19♀♀²) (19♂♂ 11♀♀ in white pans, 10♂♂ 6♀♀ in yellow pans), 2 July 2003, 18♂♂ 5♀♀ (7♂♂ 5♀♀ in white pans, 10♂♂ in yellow pans), 26 July 2003, 1♀, 22 August 2003, M. Buck. **Grey**, Hepworth dunes, 44°37'N, 81°9'W, 5♂♂ 5♀♀ (2♂♂ 3♀♀ in yellow pans, 2♂♂ 1♀ in white pans), 5 July 2003, M. Buck. **Huron**, 1♂ 2♀♀, Goderich, 22 June 1977, G.J. Umphrey, A.A. Konecny & K.N. Barber. **Simcoe**, 1♀, Springwater, 0.2 km E of Provincial Park, 44°26'11"N, 79°45'19"W, around gravel pit, 2 September

2002, M. Buck. **Dufferin**, 1♀, Primrose, 7 July 1960, D.H. Pengelly. **Peel**, 1♀, Forks of the Credit Provincial Park, 43°49'29"N, 80°0'14"W, 3 August 2002, white pans, M. Buck; 8♂♂ 5♀♀, Forks of the Credit, gravel pit NW of Provincial Park, 43°49'24"N, 80°0'57"W, 5 August 2002, M. Buck. **Wellington**, 1♂, Rockwood, 21 July 2004, on stone wall, M. Buck. **Halton**, 2♀♀, Milton, Woodland Trails Camp, 4th Line Nassagaweya, 43°32'51"N, 79°59'35"W, 18 August 2003, M. Buck & S.M. Paiero. **Norfolk**, Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 1♂ 1♀, 2 July 2000, netted, 1♀, 8 July 2000, on logs, 1♂, 8 June 2001, netted, 1♀, 25 June 2001, white pans, sandy field, M. Buck, 1♀, 7 September 2001, white pans, M. Buck & S.M. Paiero. **Middlesex**, 1♀, Komoka Feed Mill Prairie, 11-29 September 2001, yellow pans, S.M. Paiero. **Lambton**, Port Franks, Watson Property nr. L-Lake, 1♀, 12-15 July 1996, malaise trap, 1♀, 19-26 August 1996, pan trap, 2♀♀, 26 August-3 September 1996, malaise trap, J. Skevington; 1♀, Pinery Provincial Park, 2 September 1994, S.A. Marshall; 1♀, Pinery Provincial Park, powerline, 18-21 June 1986, pan traps, L. Packer (LPC). **Kent**, Rondeau Provincial Park, South Point Trail East, 1♂ 2♀♀, 29 June 2002, 8♂♂ 12♀♀, 7 September 2002, yellow and white pans, M. Buck, 13♂♂ 12♀♀, June-September 2003 (various dates), savannah and dunes, yellow and white pans, malaise trap and netted, various collectors; 1♂, Rondeau Provincial Park, Marsh Trail North, 42°18'N, 81°51'W, 15 August 2003, S.M. Paiero. **Essex**, Point Pelee, 1♀, 8 September 1954, W.R.M. Mason (CNCI), 1♀, 24 August 1961, G.K. Morris, 1♀, 20 July 1978, pan trap, K.N. Barber, 4♀♀, 21-22 July 1979, pan trap, J.M. Heraty; Point Pelee National Park, forested area by W beach, 1♂, 4-10 August 1999, 1♀, 10-21 August 1999, 1♀, 10-23 September 1999, malaise/pan traps, O. Lonsdale; Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 1♂, 29 July 2003, netted, M. Buck, 6♂♂ 1♀, 14-15 August 2003, yellow and white pans, M. Buck & D. Cheung; 1♂ 3♀♀, Point Pelee National Park, De Laurier House, 29-30 July 2003, white and yellow pans, M. Buck & D. Cheung; 3♀♀, Point Pelee National Park, Old Henry Camp, 41°57'35"N, 82°31'32"W, 14-15 August 2003, white pans, M. Buck & D. Cheung; Windsor, Ojibway Prairie, 30-31 July 2002, 1♀, yellow pans, S.M. Paiero & A. Staquet, 1♀, S.M. Paiero, 2♀♀, 19 June and 30 July 2002, on earth between roots of fallen tree, M. Buck.

Alberta: 1♀, Lethbridge, 28 July 1916, F.W.L. Sladen (CNCI).

Distribution. Newly recorded for Ontario and Alberta. Canada: NT; eastern U.S.: NY to FL, west to CO, KS and TX (Krombein 1979).

Biology. Nests in loose to well-packed sand. Small spiders of the genus *Theridion* (Theridiidae) are used as prey (Krombein 1979).

Prey records. ¹⁾ and ²⁾ One unidentified spider each.

Nitela cerasicola Pate, 1937

Ontario: **Halton**, Milton, Derry Road & 4th Line, 43°31'31"N, 79°50'25"W, 1♀, 13 July 2003, 1♂, 3 September 2003, on dead trunk, S.M. Paiero.

Distribution. Newly recorded for Canada. Eastern U.S.: NY (Krombein 1979). Apparently there are no other published records for this species besides the type series, which was collected on Long Island.

Biology. Unknown. The prey of Nearctic *Nitela* is unknown. Some Palearctic species prey on Psocoptera, Psyllidae and Aphididae (Krombein 1979).

Nitela virginensis Rohwer, 1923

Ontario: **Hastings**, 1♂, Trent River Prairie [NE of Stirling], 44°13'N, 77°34'W, 1-10 August 1994, J.T. Kerr & L. Packer (LPC). **Northumberland**, 1♂, Brighton, 15 June 1955, A.P. Arthur (CNCI). **Bruce**, Dorcas Bay dunes, 1♂, 19-30 June 1999, 1♀, 2-25 August 1999, malaise trap, S.A. Marshall. **Wellington**, 1♂, Guelph, 11 July 1956, D.H. Pengelly. **Wentworth**, Ancaster, 1♀.

8 August 1969, J.E.H. Martin (CNCI), 6♂♂, 28 June-1 July 1994, malaise trap, B. DeJonge (CNCI); Flamborough, Lawson Farm, 1♂, 2-12 July 1996, 1♂, 29 June-5 July 1997, alvar, malaise trap, B. DeJonge. **Norfolk**, 1♀, Manestar Tract, 42°43'N, 80°27'W, 30 July-4 August 1992, oak savannah, malaise trap, J.T. Kerr, M. deGiusti & L. Packer (DEBU). **Elgin**, 1♀, Aylmer West, 17-20 July 1972, malaise trap, no collector (CNCI). **Lambton**, Pinery Provincial Park, 1♀, 1-30 June 1986, malaise trap, L. Packer, 1♂, 14-21 June 1986, malaise trap, D.C. Darling & L. Packer (both ROME); 1♀, Pinery Provincial Park, powerline, 18-21 June 1986, malaise trap, L. Packer (LPC); Port Franks, Watson Property nr. L-Lake, 1♂, 12-15 July 1996, 2♀♀, 26 August-3 September 1996, malaise trap, J. Skevington; 1♂ 1♀, Port Franks, Karner Blue Sanctuary, 19-26 August 1996, malaise trap, J. Skevington. **Kent**, 1♂, Rondeau Provincial Park, Tulip Tree Trail, 26 June 1985, K.N. Barber; 4♀♀, Rondeau Provincial Park, South Point Trail, east parking lot, 42°15'42"N, 81°50'49"W, oak savannah, 16-29 July 2003, malaise trap, S.A. Marshall.

Distribution. Newly recorded for Ontario. Canada: QC (Finnamore 1982); eastern U.S.: NY, MI, WI to FL, WV, MS (Krombein 1979).

Biology. Has been reported to nest in twigs of *Rhus glabra*. See also below previous species.

Pison koreense (Radoszkowski, 1887)

Ontario: **Wellington**, 1♂, Guelph, 21 July 1978, N. Pierce. **Halton**, 1♀, Burlington, 18 August 1986, riparian woods, K.N. Barber; 1♀, Milton, Derry Road & 4th Line, 29 June 1999, S.M. Paiero; 1♀, Oakville, nr. Hwy 25 & Burnhamthorpe Road, 43°27'14"N, 79°47'32"W, 9 August 2002, S.M. Paiero. **Essex**, 1♀, Windsor, ca. 1.5 km S Ojibway Prairie, 42°13'34"N, 83°4'27"W, 30 June-17 July 2001, forest-prairie edge, malaise trap, P. Pratt; 1♀, Windsor, Ojibway Prairie, 26 August 2002, on earth between roots of fallen tree, S.M. Paiero.

Distribution. Genus and species newly recorded for Canada. U.S.: NY, PA, MI, WI, IL, MD, VA, KS, TX (Kurczewski and Miller 1991; Antropov 1994). Russian Far East, eastern China, Korea, Japan (Antropov 1994). This Old World species was introduced to the eastern U.S. after World War II (Krombein 1979) and is apparently expanding its range (Kurczewski and Miller 1991).

Biology. *P. koreense* constructs mud cells, often in sheltered situations, and sometimes uses old nests of the mud dauber *Trypoxylon politum* (Say). Prey are spiders of the genera *Araneus* (Araneidae) and *Dictyna* (Dictynidae) (Menke 1988).

Trypoxylon (s. str.) *attenuatum* Smith, 1851

Ontario: **Parry Sound**, 1♀, N of Parry Sound, Nobel Township, 3-4 August 2002, yellow pans, E.L. Westman. **Carleton**, Ottawa, 2♀♀, August 1993 and 7 September 2002, J.R. Vockeroth (CNCI), 1♂, 25 May 1975, R.E. Roughley. **Lanark**, 3♀♀, 7 km SW Carleton Place, 4-11 September 1980, S.J. Miller (CNCI). **Leeds and Grenville**, 1♂, Prescott, 7 September 1978, K.N. Barber; 1♀, Greenbush, 25 August 1999, flight intercept trap, R. Hainault (CNCI); 23♂♂ 29♀♀, St. Lawrence Is. National Park, 1975-76 (CNCI), 1♂ 2 ♀♀, ditto, Grenadier I. Centre (CNCI), 1♀, ditto, McDonald I., 13 September 1976, malaise trap, W. Reid (CNCI). **Hastings**, 1♂, Foxboro, 10 June 1963, C.J. Edwards; 2♀♀, Trent River Prairie, [NE of Stirling], 44°13'N, 77°34'W, 23-31 August 1994, oak savannah, malaise trap, J.T. Kerr, M. deGiusti & L. Packer (LPC). **Peterborough**, 1♂, Miller Creek Conservation Area, 5 June 1999, W.J. Crins. **Bruce**, 1♂, Dunks Bay, 45°14'59"N, 81°38'27"W, 31 July 1997, malaise trap, S.A. Marshall; 1♂, Bruce Pen. National Park, Singing Sands, 45°11'34"N, 81°34'58"W, 26-31 May 2000, fen, pan traps, C.S. Onodera; Dorcas Bay, 45°11'N, 81°35'W, 1♀, 19-24 August 1997, 3♀♀, 30 June-21 July 2003, dune, malaise trap, S.A. Marshall; Emmett Lake, 1♂, 27 May-10 June 2000, 2♂♂ 1♀, 16 August 2000, malaise trap, S.A. Marshall; 1♀, 2 km W Tobermory, 1-3 July 1988, roadside fen, pan traps, D. Blades; 1♀, N of

Boat Lake, 22 July 1977, lush forest nr. swamp, D. Maddison (ROME); 1 ♀, Pike Bay (Bruce County?), 30 July–7 August 1996. L.L. Wood; 30 ♂♂ 24 ♀♀, Inverhuron Provincial Park, 6 June–10 September 2003 (various dates), dunes, yellow and white pans, malaise trap and netted, M. Buck & S.A. Marshall. **Grey**, 1 ♀, Meaford, 30 July 1964, B.K.W. Wyatt. **Huron**, 2 ♂♂, Goderich, 22 June 1977, A.A. Konecny & W.A. Attwater; 1 ♀, Goderich, Maitland River at Hwy 21, 20 July 1977, field, D. Maddison (ROME). **Simcoe**, 2 ♀♀, Beeton, 5 October 1979, D.N. Couture; 1 ♀, Barrie, April 1983, ex *Rhus* twig (emerged 4–6 June 1983), E.R. Fuller (ROME). **Simcoe or York**, 1 ♂, Schomberg, 14 September 1975, J.T. Huber. **Dufferin**, 1 ♂ 1 ♀, Mono Cliffs Provincial Park, 44°3'N, 80°4'W, 31 August 2002, yellow pans, M. Buck. **Peel**, 2 ♀♀, Forks of the Credit Provincial Park, 43°49'29"N, 80°0'14"W, 3 August 2002, white pans, M. Buck; 1 ♀, Forks of the Credit, gravel pit NW of Provincial Park, 43°49'24"N, 80°0'57"W, 5 August 2002, white pans, M. Buck. **Wellington**, 15 ♀♀, Wyld Lake bog 8 km E Arthur, 20 August–23 October 1987, pan traps, S.A. Marshall; 1 ♂, Rockwood, 21 September 1963, D.B. Stoltz; 1 ♀, Belwood, 21 June 1973, D.H. Pengelly; Guelph, 1 ♀, 11 September 1960, B.S. Heming, 1 ♀, 3 June 1974, R.E. Roughley, 1 ♂, 16 August 1976, P.R. Heels, 1 ♀, 23 August 1977, K.N. Barber, 1 ♂, 24–28 August 1981, 1 ♀, 7–12 September 1981, malaise trap, D. Yu, 1 ♀, 15 June 1983, G. Abayo, 1 ♂, October 1994, C. Brewer, 1 ♀, 7–10 September 2001, pan traps, J. Knopp; 1 ♂, Crieff, 2 km SE on 7th Conc., 43°24'57"N, 80°7'18"W, 30 August 2002, S.A. Marshall. **Waterloo**, 5 ♀♀, Elmira, 5–28 October 1977, L. LeSage (CNCI); 1 ♀, Cambridge, 15 June 1975, W.J. Moolenbeek; 1 ♀, Cambridge, Cambridge Research Station, 9–12 June 1992, malaise trap, J. Skevington; 2 ♂♂ 9 ♀♀, Oliver Bog 3 km S Galt, 13 May–11 October 1987, pan traps, D. Blades. **Halton**, 2 ♂♂, Oakville, 22 May and 13 June 1976, W.A. Attwater. **Wentworth**, 1 ♀, Ancaster, 43°13'N, 79°59'W, 28 May–4 June 1994, prairie, malaise trap, B. DeJonge; 1 ♂, Ancaster vicinity, 43°15'N, 80°0'W, 27 May–2 June 1995, bush/prairie, malaise trap, B. DeJonge; Ancaster, Newton Woods, 1 ♂, 10–17 June 1996, 1 ♂, 17–24 June 1996, forest, malaise trap, B. DeJonge. **Welland**, 2 ♀♀, Wainfleet Bog, 8 km S Welland, 14 September–5 October 1987, pan traps, A. Stirling; 1 ♀, Fonthill, 11 August 1984, malaise trap, M.A. Luciani. **Lincoln**, 1 ♂, Vineland, 24 June 1978, D. Yu. **Brant**, Brantford Railway Prairie, 43°10'N, 80°19'W, 1 ♂, 6 June 2002, yellow pans, 1 ♂, 12 July 2002, 1 ♀, 24 July 2002, M. Buck & S.M. Paiero. **Norfolk**, 1 ♀, Long Point – RARO, 20–23 June 1996, malaise trap, P.J. Carson (LPC). **Lambton**, 3 ♀♀, Port Franks, Watson property nr. L-Lake, 10 June–14 August 1996, malaise trap, J. Skevington; 1 ♂, Walpole I., 42°29.9'N, 82°29.3'W, 1–16 August 2001, marsh, malaise trap, Guidotti et al. (ROME); Walpole I., Potawatomi Prairie, 42°33'N, 82°29'W, 1 ♂, 11–19 July 2001, 1 ♀, 19–25 July 2001, 1 ♂, 1–16 August 2001, malaise trap, Guidotti et al. (ROME). **Kent**, Rondeau Provincial Park, South Point Trail East, 3 ♀♀, 29 June 2002, netted, 2 ♀♀, 7 September 2002, yellow pans, M. Buck, 2 ♂♂ 1 ♀, 29 May 2003, yellow pans, M. Buck & S.M. Paiero, 1 ♂ 2 ♀♀, 16–29 July 2003, malaise trap, oak savannah, S.A. Marshall; 2 ♂♂ 1 ♀, Wheatley Provincial Park, 9 June 2002, S.M. Paiero. **Essex**, 1 ♀, Point Pelee National Park, wooded area by W beach, 20–26 July 1999, malaise/pans, O. Lonsdale; 1 ♀, Point Pelee National Park, Visitor Centre, 29 May–9 June 2000, malaise /pans, O. Lonsdale; 1 ♀, Union-on-the-Lake, Erie beach, 18 August 1983, T.D. & C.A. Galloway (EDUM); Windsor, Ojibway Prairie, 1 ♀, 28–30 August 2001, 1 ♀, 4–7 September 2001, 1 ♀, 7–11 September 2001, 2 ♂♂, 30 May 2002, yellow pans, S.M. Paiero, 1 ♂, 19 June 2002, M. Buck; 2 ♀♀, Windsor, Ojibway Prairie nr. Sprucewood Avenue, 26–27 August 2002, white and yellow pans, M. Buck & S.M. Paiero.

Quebec: 2 ♂♂ 3 ♀♀, Ste-Anne-de-Bellevue, various dates, July, September, 1967, 1976, 1978, various collectors (LEMQ); 7 ♂♂ 12 ♀♀, Mont St. Hilaire, various dates, July–August 1977, A.T. Finnermore (LEMQ).

Distribution. Newly recorded for Canada (ON, QC). A Palearctic species that was only recently discovered in the Nearctic (U.S.): VT (Antropov 2003). Nearctic specimens were previously

confused with the similar *T. pennsylvanicum*. The female collected in Guelph in 1960 represents the oldest known specimen from the Nearctic region.

Biology. Nests in hollow plant stems, usually *Phragmites*. Prey are spiders of various genera (Lomholdt 1975-76).

***Trypoxylon* (s. str.) *bidentatum* Fox, 1891**

Ontario: Prince Edward, 1♂, Smith Bay nr. Picton, 1 July 1970, J.F. McAlpine (CNCI, Antropov *in litt.*).

Distribution. Newly recorded for Canada. Western U.S.: WA, ID south to CA, AZ (Krombein 1979). According to Antropov (*in litt.*) also in BC (specimens in CNCI). Possibly adventitious in the east (see Discussion).

Biology. Nests in borings of *Sambucus* and was also reported from trap stems (Krombein 1979). Prey unknown, probably spiders.

***Trypoxylon* (s. str.) *carinatum* Say, 1837**

Ontario: Hastings, 1♀, Trent River Prairie [NE of Stirling], 44°13'N, 77°34'W, 19 July-2 August 1994, J.T. Kerr & L. Packer (LPC). **Halton or Peel**, Terra Cotta, 1♂ (head missing), reared from trap nest #50, 1♂ 4 specimens (heavily damaged), reared from trap nest #54289, 2001, T. Romankova. **Wentworth**, Dundas, 1♀, 7-11 August 1972, D.M. Wood (CNCI, not examined; information provided by A. Antropov, *in litt.*), 2♂♂, 8 July 1980, E.A. Menard; 1♂, nr. Carlisle, 10 June-12 July 1996, logs, tepee trap, B. DeJonge; 1♀, Ancaster, Newton Woods, 12-20 July 1996, forest, malaise trap, B. DeJonge. **Lincoln**, 1♀, Vineland, 13 July 1979, D. Yu. **Norfolk**, Manestar Tract, 42°43'N, 80°27'W, 1♀, 10-18 July 1992, 2♀♀, 18-30 July 1992, 1♂ 1♀, 30 July-4 August 1992, malaise trap, oak savannah, P.J. Carson, J.T. Kerr, M. deGiusti & L. Packer (all LPC). **Lambton**, 1♂, Port Franks, Karner Blue Sanctuary, 27 June-2 July 1996, malaise trap, J. Skevington; 1♀, same data except 22-25 July 1996; Port Franks, Watson Property nr. L-Lake, 1♂, 8-12 July 1996, 1♀, 15-18 July 1996, malaise trap, J. Skevington. **Kent**, 1♀, Rondeau Provincial Park, 1-6 July 1973, malaise trap, no collector (CNCI). **Essex**, 1♀, Harrow, 11 July 1976, C.D. Neilsen. **Not located:** 1♂, "Byron, 23/7/[?]36". The name (if it does not indicate the collector) could refer to a Byron nr. London (Middlesex County) but it is not clear whether the specimen is from Ontario.

Distribution. Newly recorded for Canada. U.S.: east of 100th meridian, north to MA (Krombein 1979).

Biology. Nests in wood borings. Reported prey is the spider *Theridion lyricum* Walckenaer (Theridiidae) (Krombein 1979).

***Trypoxylon* (s. str.) *clarkei* Krombein, 1962**

Ontario: Halton, 1♀, Halton Hills, 24 July 1981, G. Aiudi; Oakville, nr. Hwy 25 & Burnhamthorpe Road, 43°27'14"N, 79°47'32"W, 1♀, 9 August 2002, 2♀♀, 16 August 2002, on earth between roots of fallen tree, S.M. Paiero. **Wentworth**, 1♂, Dundas, 4 July 1980, E.A. Menard; 1♀, Hamilton, 9-13 July 1981, M. Sanborne (CNCI); 1♂, nr. Carlisle, 10 June-12 July 1996, logs, tepee trap, B. DeJonge; Ancaster, Newton Woods, 1♂, 2-12 July 1996, 1♀, 27 July-4 August 1996, 1♀, 4-10 August 1996, forest, malaise trap, B. DeJonge.

Distribution. Newly recorded for Canada. Eastern U.S.: MA, NY, IL to MO, FL, TX (Krombein 1979).

Biology. Reared from trap nests. Recorded prey is the spider *Mangora gibberosa* Hentz. (Araneidae) (Krombein 1979).

***Trypoxylon kolazyi* Kohl 1893**

Ontario: Wellington, Guelph, 3♂♂, 5 July 1965, 3♀♀, 12 and 19 July 1965, C.J. Edwards. **Waterloo**, 6♂♂ 11♀♀, Roseville, 5 May 1954, E.F. Cook; 1♀, Elmira, Salem Creek, 13 September 1977, L. LeSage (CNCI). **Wentworth**, 2♂♂, Winona, 10 July 1952, A.R. Gittins. **Middlesex**, 1♂, London, June 1957, N.R. Couling (CNCI, *Antropov in litt.*).

Distribution. Newly recorded for Canada. Introduced to eastern U.S. from Palaearctic Region: NY to GA, WV, IL, MO (Krombein 1979). Previous records from Ontario (Romel & Dykstra 1991b, Sugar et al. 1998, Skevington et al. 2001) are very likely based on misidentifications (see below).

Biology. Nests in abandoned anobiid borings in wood. Prey are adult and subadult Linyphiidae and Micryphantidae spiders (Krombein 1979).

Note. Most of the previous Ontario records of this species (Romel & Dykstra 1991b, Sugar et al. 1998) were under the synonym *T. backi* Sandhouse, 1940. At the time when this species was described the very similar *T. clavicerum* Lepeletier & Serville, another introduced Palaearctic species, was not yet recorded from the Nearctic Region. In the most recent key to Nearctic *Trypoxylon* (s. str.) (Sandhouse 1940) *T. clavicerum* keys to *T. backi*, leading to confusion between the two species. Even though *T. clavicerum* had been present in eastern North America from at least the late 1940s the species was not recorded before 1984 (Coville 1984). Coville's small note is the only Nearctic reference to distinguish between the two species. *T. clavicerum* is fairly common and widespread in southern Ontario whereas *T. kolazyi* is very rare and has not been collected in more recent times. Considering these facts previous Ontario records of *T. kolazyi* under the synonym *T. backi* (i.e., Romel & Dykstra 1991b, Sugar et al. 1998) are very doubtful. Some of the material on which Skevington et al. (2001) based their species list was re-examined and did not contain any *T. kolazyi* but did include several *T. clavicerum*, which was not mentioned in their list.

***Trypoxylon* (s. str.) *sculleni* Sandhouse, 1940**

Ontario: Leeds and Grenville, 1♂, St. Lawrence Is. National Park, 1975/76 (CNCI, *Antropov in litt.*).

Distribution. Newly recorded for eastern Canada. Canada: AB (Finnamore 1994), BC; western U.S.: MT to AZ, CA (Krombein 1979). Possibly adventitious in the east (see Discussion).

Biology. Nests in cavities in twigs and stems. Prey are spiders (Krombein 1979).

***Trypoxylon* (*Trypargilum*) *tridentatum tridentatum* Packard, 1867**

Ontario: Welland, 1♂, Fonthill, 9 August 1989, M.D. Forward. **Essex**, 1♂, Harrow, 7 August 1973, R.E. Roughley.

Distribution. Newly recorded for eastern Canada. Canada: BC; transcontinental in U.S.: CT to northern FL (incl. NY, PA, OH, MI), west to WA and CA; Mexico south to Isthmus of Tehuantepec (Coville 1982).

Biology. Nests in stems, wood borings and old mud dauber nests (Krombein 1979). Prey are spiders of various families, preferably snare-building species (Coville 1982).

***Oxybelus cressonii* Robertson, 1889**

Ontario: Kent, 1♀, Rondeau Provincial Park, group campground, 21 July 2004, D. Cheung. **Lambton**, 1♀, Port Franks, Watson Property nr. L-Lake, 14-15 August 1996, malaise trap, J. Skevington. **Essex**, Windsor, Ojibway Prairie, 3♂♂, 30-31 July 2002, S.M. Paiero, 8♂♂ 2♀♀, 26-27 August 2002, M. Buck & S.M. Paiero, 10♂♂ 3♀♀, 12-13 September 2002, M. Buck; Windsor, Springarden Road ANSI, 43♂♂ 20♀♀*), 31 July 2002, M. Buck, 2♂♂ 5♀♀, 27 August 2002, M. Buck & S.M. Paiero.

Distribution. Newly recorded for Canada. Central and eastern U.S.: UT and TX east to VA, north to MI (Krombein 1979).

Biology. Nests in sand. Prey are Diptera of several unrelated families (Chloropidae, Stratiomyidae, Chironomidae) (Krombein 1979).

Prey record. *) One male *Thaumatomyia* sp. (Chloropidae).

***Oxybelus decorosus* (Mickel, 1916)**

Ontario: Sudbury, 2♂♂, Nairn Centre, Old Nairn Road nr. Hwy 17, 46°19'35"N, 81°37'6"W, 6 July 2002, M. Buck. **Lambton,** 1♂, Forest, 17 June 1974, J.D. Villa. **Essex,** Windsor, Ojibway Prairie, 2♂♂, 26-27 August 2002, M. Buck & S.M. Paiero, 5♂♂ 4♀♀, 12-13 September 2002, M. Buck.

Distribution. Newly recorded for Canada. U.S. east of 100th meridian: VT and MN south to FL (Krombein 1979).

Biology. Unknown. As for other members of the genus, probably ground-nesting and preying on adult Diptera.

***Oxybelus inornatus* (Robertson, 1901)**

Ontario: Peel, 1♂, Forks of the Credit, 22 June 1965, G. Knerer (ROME).

Distribution. Newly recorded for Canada. Northeastern U.S.: MI to MA, south to NC (Krombein 1979).

Biology. *Pholeomyia indecora* (Loew) (Milichiidae) has been recorded as prey (Krombein 1979).

***Oxybelus laetus laetus* Say, 1837**

Ontario: **Lambton,** Port Franks, Watson Property nr. L-Lake, 1♂, 2-4 July 1996, 1♂ 1♀, 12-15 July 1996, 1♀, 15-18 July 1996, 1♀, 18-22 July 1996, malaise trap, J. Skevington; 1♂, Pinery Provincial Park, Cedar Trail, 16-20 July 1994, oak savannah, malaise trap, J. Skevington.

Distribution. Newly recorded for Canada. U.S. east of 100th meridian: MI and MA south to TX and NC (Krombein 1979). Finnamore (1982) erroneously recorded this species from Quebec based on a misidentified female of *O. subulatus* (specimen in LEMQ, examined).

Biology. Unknown. As for other members of the genus, probably ground-nesting and preying on adult Diptera.

***Oxybelus sericeus* Robertson, 1889**

Ontario: **Rainy River,** 2♀♀, Windy Point, 4 August 1960, S.M. Clark (CNCI).

Quebec: 1♀, New Richmond, 6 August 1954, J.E.H. Martin (CNCI).

Distribution. Newly recorded for Canada (ON, QC). U.S.: MA to FL, west to SD, UT, OR and CA; Mexico: Baja California, Nayarit (Krombein 1979).

Biology. Nests in moist sand. Prey are flies of the genera *Ephydra* (Ephydriidae) and *Chaetopsis* (Otitidae) (Krombein 1979).

***Oxybelus subcornutus* Cockerell, 1895**

Ontario: **Northumberland,** 1♀, Murray Township, Murray Sand Hills, 28 July 1996, F.E. Kurczewski (FEK). **Wellington,** Guelph, 1♂, 27 June 1960, 1♂, 7 July 1976, D.H. Pengelly. **Norfolk,** 3♂♂, Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 3 August 2001, sandy field, M. Buck; 1♂, St. Williams Nursery Tract, 42°41'39"N, 80°29'7"E, 6 August 2001, A. Timpf & M. Gartshore. **Essex,** 1♂, Point Pelee, 30 July 1978, W.A. Attwater; 1♂,

2 August 1981, G. Aiudi; Windsor, Ojibway Prairie, 2♂♂, 30-31 July 2002, M. Buck & S.M. Paiero, 1♂, 27 August 2002, 2♀♀, 12-13 September 2002, M. Buck.

Distribution. Newly recorded for Canada. Eastern U.S.: East Coast to AZ, north to NY, MI; Mexico: Chihuahua (Krombein 1979).

Biology. Nests in sand. Prey are adult Syrphidae, apparently mostly males (Krombein 1979).

Entomognathus (Toncahua) lenapeorum Viereck, 1904

Ontario: Essex, Windsor, Ojibway Prairie, 42°15'51"N, 83°4'30"W, 1♂, 30 August 2001, S.M. Paiero, 1♀, 26 August 2002, M. Buck.

Distribution. Genus and species newly recorded for Canada. Eastern U.S.: PA (Kurczewski and Miller 1991), NJ to VA, KS (Krombein 1979).

Biology. Unknown. Prey are probably adult Chrysomelidae as for other species of the genus (Krombein 1979).

Entomognathus (Toncahua) memorialis Banks, 1921

Ontario: Brant, Brantford Railway Prairie, 43°10'N, 80°19'W, 4♀♀, 12 July 2002, S.M. Paiero, 9♂♂ 7♀♀*), 24 July 2002, M. Buck & S.M. Paiero. **Lambton**, 1♀, Port Franks, Watson Property nr. L-Lake, 31 July-6 August 1996, malaise trap, J. Skevington. **Kent**, 1♂, Bothwell, 11 July 1962, S.M. Clark (CNCI); 1♀, Wheatley, 15 August 1982, T.D. Galloway (EDUM). **Essex**, 1♀*), Windsor, Ojibway Prairie, 30-31 July 2002, S.M. Paiero.

Distribution. Newly recorded for Canada. Eastern U.S.: CT to VA, KS (Krombein 1979).

Biology. Nests in sandy-loam cliffs, sometimes in pre-existing burrows. Prey are adults of the genus *Altica* (Chrysomelidae) (Krombein 1979).

Prey records. *) One adult *Altica* sp. each.

Rhopalum (Corynopus) occidentale (Fox, 1895)

Ontario: Algoma, 1♀, Wawa, 7 August 1992, D.G. Bennett. **Hastings**, 1♀, Belleville, 4 June 1932, W.E. Steenburgh (CNCI). **Bruce**, 1♂, Fathom Five National Park, Flowerpot I., 12 July 1996, S.A. Marshall; 1♀, Cyprus Lake, 30 June 1954, D.H. Pengelly; 1♂ 1♀, Dorcas Bay, 5-13 June 1999, dunes, malaise trap, S.A. Marshall. **Wentworth**, Dundas, 1♂, 28 May 1980, 1♀, 2 June 1980, E.A. Menard. **Norfolk**, 1♀, Manestar Tract, 42°43'N, 80°27'W, 11-15 June 1992, oak savannah, malaise trap, P.J. Carson (LPC).

Distribution. Newly recorded for Ontario. Canada: QC (Finnamore 1982), BC; northern and western U.S.: ME, CT, NY, NC, MI, CO, WY, NV, CA, OR (Krombein 1979).

Biology. Probably ground-nesting (Bohart 1974). Prey unknown.

Rhopalum (Corynopus) pedicellatum Packard, 1867

Ontario: Algoma, 1♂ 1♀, Icewater Creek watershed, 13.5 km NNE Searchmont, Whitman Dam Road mi 11.5, 20 June 1986, sandy access road, K.N. Barber. **Carleton**, Ottawa, 1♀ (pinned with raspberry stem), 24 August 1954, ex raspberry stem, O. Peck, 1♀, 15 July 1957, J.E.H. Martin (both CNCI); 1♀, locality not stated [= Ottawa area], W.H. Harrington collection (CNCI); 1♂, Stittsville, 23 June 1963, W.R.M. Mason (CNCI). **Hastings**, 1♀, Trent River Prairie [NE of Stirling], 44°13'N, 77°34'W, 23-31 August 1994, oak savannah, malaise trap, J.T. Kerr, M. deGiusti & L. Packer (LPC). **Lambton**, 1♀, Pinery Provincial Park, 1-30 June 1986, malaise trap, L. Packer (ROME); 1♀, Port Franks, Karner Blue Sanctuary, 6-12 August 1994, J.T. Kerr & L. Packer (LPC). **Kent**, 1♂, Rondeau Provincial Park, 15 June-14 July 1979, malaise trap, L. Masner (CNCI).

Quebec: 1♀, "Ste Anne de la Porcatière" [= Ste-Anne-de-la-Pocatière], 7 August 1914, F.W.L. Sladen (CNCI); 1♀, St. Anne's, 11 June 1933 (CNCI).

Distribution. Newly recorded for Canada (ON, QC). U.S.: ME, MA, CT, NY, MD, WI, MN, CO (Krombein 1979). Harrington (1902) erroneously recorded the species from Ontario (see section on misidentifications [p. 76]).

Biology. Nests in pre-existing cavities in dead wood and twigs. Prey are *Chironomus* spp. (Chironomidae) (Krombein 1979).

***Rhopalum rufigaster* Packard, 1867**

Ontario: Carleton, 1♀, Stittsville, 23 June 1963, W.R.M. Mason (CNCI). Lanark, 1♀, Innisville, 22 August 1963, W.R.M. Mason (CNCI); 1♂ 2♀♀, Lanark, 2 August 1976, M.J. Sharkey; 2♀♀, Fallbrook, 14 August 1974, J.T. Huber; 1♀, 7.5 km W Carleton Place, 14 October 2000, woods, yellow pans, L. Masner (CNCI). **Leeds and Grenville,** 1♀, Kemptville, 30 August 1983, maple forest, malaise trap, W.R.M. Mason (CNCI); 1♀, Lyn, 10 August 1926, F.P. Ide (CNCI); 2♀♀, St. Lawrence Is. National Park, Grenadier I. Centre, 18 July and 1 August 1975, E. Sigler (CNCI); 1♀, same except McDonald I., 20 August 1976, Reid (CNCI). **Hastings,** 1♀, Marmora, 14 June 1952, J.R. Vockereth (CNCI); 1♀, Belleville, 16 July 1949, J.C. Martin (CNCI). **Bruce,** 1♀, Bruce Peninsula National Park, Emmett Lake, 16 August 2000, lake edge, malaise trap, S.A. Marshall. **Huron,** 1♂, Goderich, 22 June 1977, K.N. Barber. **York,** 1♀, Toronto, August 1937, no collector (USNM). **Lincoln,** 2♂♂, Vineland, 15 June 1943, "*Agrilus communis rubicola* cage", H.R. Boyce (CNCI). **Lambton,** Pinery Provincial Park, 1♀, 7-10 June 1986, 1♀, 11-14 June 1986, 1♀, 18-21 June 1986, malaise trap, L. Packer (LPC). **Kent,** 1♀, "Guild" [= Guilds], 14 July 1962, S.M. Clark (CNCI); 2♂♂ 5♀♀, Rondeau Provincial Park, 22 June, 5, 10, 14, 17 and 18 July 1962, S.M. Clark (CNCI); Rondeau Provincial Park, South Point Trail East, oak savannah, 1♀, 7 September 2002, M. Buck, 1♂, 29 May 2003, yellow pans, M. Buck & S.M. Paiero, 1♂ 1♀, 16-29 July 2003, malaise trap, S.A. Marshall. **Essex,** Point Pelee, 2♂♂ 2♀♀, 8-9 September 1954, G.S. Walley & W.R.M. Mason (CNCI); 9♂♂ 14♀♀, 30 June 1978, 17-20 and 28-31 July 1978, W.A. Attwater, D. Morris, K.N. Barber & J. Cappleman, 2♂♂ 3♀♀, June-July, 1979-1981, various collectors, 1♂, 18 June 1986, no collector, 1♀, 14-20 July 1999, malaise/pan trap, A. Tesolin; Point Pelee National Park, Visitor Centre, 1♀, 29 May-9 June 2000, 1♀, 23 June-4 July 2000, 1♂, 22-30 July 2000, malaise/pan trap, O. Lonsdale; Kingsville, 1♂, 9 June 1973, R.E. Roughley, 1♀, 8 July 1977, K.N. Barber; 3♂♂, Pelee I., Stone Road Alvar FON Reserve, 41°45'20"N, 82°37'54"W, 9 June 2002, M. Buck; 7♂♂ 18♀♀, Pelee I., Porchuk property, 9 June-27 September 2002 (various dates), malaise trap, B. Porchuk & S.A. Marshall; 5♂♂, Middle I., 41°41'N, 82°41'W, 11 June 2003, yellow pans, S.A. Marshall; 5♂♂ 7♀♀, East Sister I. Provincial Nature Reserve, 41°49'N, 82°51'W, 30 July 2003, yellow pans (excl. 1♂ 1♀), S.A. Marshall; Harrow, 1♀, 2 August 1973, R.E. Roughley, 1♀, 22 August 1974, J.T. Huber; 1♂, Windsor, 8 June 1976, J.F. Fortin.

Distribution. Newly recorded for Ontario. Canada: QC (Finnamore 1983); U.S. east of 100th meridian (Krombein 1979). Harrington (1902) erroneously recorded the species from Ontario (see section on misidentifications [p. 76]).

Biology. Nests in stems and old beetle borings in wood. Prey are mainly adult Chironomidae, rarely Limoniinae (Tipulidae) and Ceratopogonidae (Krombein 1979).

***Crossocerus (Ablepharipus) unicus* (Patton, 1879)**

Ontario: Parry Sound, 1♀, Kearney, M.C. VanDuzee (CASC). Brant, 1♀, Ohsweken, 19 June 1979, D. Morris.

Distribution. Newly recorded for Ontario. Canada: QC (Finnamore 1982), MB; U.S.: CT, NY, PA, MI, MN, IN, MT (Krombein 1979).

Biology. Unknown.

***Crabro cognatus* Fox, 1895**

Ontario: **Wellington**, Guelph, 1♂ 1♀, 4 August 1978, K.N. Barber, 1♂, 25 August 1978, R.O. Kreuzer, 1♂, 15 August 1970, K.A. Stewart; Elora, 1♀, 10 September 1996, soy field, A. Shekhirman, 1♀, 3 September 2001, mown meadow, H.R. Mattila. **Waterloo**, 1♀, Cambridge, 9 August 1981, C. Bolter.

Distribution. Newly recorded for eastern Canada. Canada: AB to MB; U.S.: NH to ID, GA to TX and UT (Miller 1976; Krombein 1979).

Biology. Unknown. Like other species in the genus probably ground-nesting and preying on adult Diptera.

***Crabro nigriceps* Bohart, 1976**

Ontario: **Nipissing** (probably), 1♂, Algonquin [Provincial Park], 10 July 1961, R.J. Pilfrey.

Distribution. Newly recorded for Ontario. Known only from holotype and one paratype: Canada, MB (The Pas) and U.S., ME (Aziscoos Lake) (Bohart 1976).

Biology. Unknown. See below previous species.

***Crabro snowii* Fox, 1896**

Ontario: **Parry Sound** 1♂, Powassan, 11 July 1978, S.M. Ball. **Essex**, Windsor, Ojibway Prairie, 42°15'46"N, 83°4'1"W, 1♀, 24-27 July 2001, unburnt forest, 1♀, 25 July 2003, S.M. Paiero.

Distribution. Newly recorded for eastern Canada. Western Canada: MB, SK; U.S.: NY to FL, MN to KS (Miller 1976; Krombein 1979).

Biology. Unknown. See below *C. cognatus*.

***Crabro vernalis* (Packard, 1867)**

Ontario: **Kenora**, 2♂♂, Ignace, 20 May 1978, J.A. Carson.

Distribution. Newly recorded for Ontario. Canada: NF, QC, MB, AB, BC, NT, YT; U.S.: AK, WY, CO, MN, IL, NJ (Bohart 1976). Krombein (1979) listed this species as "transcontinental in North America in Transitional Zone including Alaska" but there appears to be no previous record from Ontario.

Biology. Unknown. See below *C. cognatus*.

***Ectemnius decemmaculatus decemmaculatus* (Say, 1823)**

Ontario: **Kent**, Rondeau Provincial Park, South Point Trail East, 10♂♂ 2♀♀, 7 September 2002, 4♂♂ 5♀♀, 5-6 September 2003, M. Buck; 1♂, Rondeau Provincial Park, South Point, 42°15'N, 81°52'W, 7 September 2003, M. Buck; 4♂♂ 4♀♀, Rondeau Provincial Park, Lakeshore Road, Beach Access #11, 42°16'1"N, 81°50'39"W, 10 August 2003, dunes, M. Buck; 1♀, Rondeau Provincial Park, 16 July 2003, O. Lonsdale. **Essex**, 2♂♂, Point Pelee, 16 June and 23 August 1920, N.K. Bigelow (ROME); 1♂, Point Pelee National Park, De Laurier Trail, 11 August 1999, O. Lonsdale.

Distribution. Newly recorded for Canada. U.S. east of Rocky Mts., Mexico (Bohart and Menke 1976). Harrington (1902) erroneously recorded the species from Ontario (see section on misidentifications [p. 76]).

Biology. Unknown. Probably nesting in dead wood or plant stems and preying on adult Diptera like most members of the genus.

***Ectemnius dilectus* (Cresson, 1865)**

Ontario: Algoma, 1♂, Sault Ste. Marie, 13 July 1963, D.B. Stoltz. Essex, Windsor, Ojibway Prairie, 2♂♂, 7 August 2001, S.M. Paiero, 1♂, 18 June 2002, M. Buck, 2♂♂, 20 July 2002, S.A. Marshall, 4♂♂ 3♀♀, 26-27 August 2002, 10♂♂ 1♀, 12-13 September 2002, M. Buck & S.M. Paiero, 1♂, 26-27 August 2002, sandy savannah, yellow pans, M. Buck.

Distribution. Newly recorded for eastern Canada. Canada: AB (Strickland 1947); Transitional and Upper Austral Zones of most of the U.S. except west of the Sierra Nevada and Cascade Ranges (Krombein 1979).

Biology. Unknown. Probably ground-nesting (Krombein 1979).

***Ectemnius scaber scaber* (Lepeletier & Brullé, 1834)**

Ontario: Wellington, 1♀, Guelph, 1 July 1974, J.T. Huber. Essex, 1♂, Harrow, 6 September 1959, D.H. Pengelly; Windsor, Ojibway Prairie, 3♂♂, 18-19 June 2002, M. Buck & S.M. Paiero, 1♂ 5♀♀, 30 July 2002, 1♂, 27 August 2002, M. Buck; 1♀, Windsor, Springarden Road ANSI, 31 July 2002, S.M. Paiero.

Distribution. Newly recorded for Canada. Eastern U.S.: PA, NJ to FL, LA, TX, and OK (Krombein 1979).

Biology. Nests in pine (Krombein 1979). Prey unknown, probably Diptera.

Subfamily Bembicinae***Mellinus abdominalis* Cresson, 1882**

Ontario: Manitoulin, Manitoulin I., Carter Bay, dunes, 45°36'23"N, 82°8'27"W, 1♀, 1 August 2003, S.M. Paiero, 1♂, 1-8 August 2003, malaise trap, M. Buck & S.A. Marshall, 1♀, 6-8 August 2003, yellow pans, 1♂, 8 August 2003, 1♀*), 28 August 2003, S.A. Marshall.

Saskatchewan: 1♀, Tunstal [= Tunstall], 27 August 1957, A.R. & J.E. Brooks (CNCI); 11♂♂ 3♀♀, Pike Lake, 10 August 1939, A.R. Brooks (CNCI); 1♀, File Lake, 9-11 July 1973, malaise trap, lakeshore, L. Masner (CNCI); 1♂, Great Sand Hills, 50°42'N, 109°17'W, 16-19 June 1988, M. Polak (CNCI).

Distribution. Newly recorded for Ontario and Saskatchewan. Canada: AB (Strickland 1947); western U.S.: ID (Johnson 1985), MT, WY, NE, CO (Krombein 1979).

Biology. Probably ground-nesting like other species of the genus (Krombein 1979). Strickland (1947) records an Anthomyiidae fly as prey.

Prey record. *) S.A. Marshall (pers. comm.) observed a female chewing on a muscoid fly (documented by photograph). Adult feeding on prey is uncommon in Crabronidae and has never been observed before in *Mellinus*.

***Didineis dilata* Malloch and Rohwer, 1930**

Ontario: Wellington, 1♂, Guelph, 19 July 1977, D. Levin.

Saskatchewan: 1♂, Willow Bunch 28 July 1955, C.D. Miller (CNCI); 1♂, Saskatoon, 4 August 1960, A.R. Brooks (CNCI).

Alberta: 1♂, Lethbridge, 7 July 1956, O. Peck (CNCI).

Distribution. Genus and species newly recorded for Canada (ON, SK, AB). U.S.: WI, NE (Krombein 1979).

Biology. Unknown. Probably ground-nesting and preying on Homoptera as other species of the genus (Ferton 1912).

Note. The female of this species is unknown. It might be confused with one of the following species.

***Didineis latimana* Malloch and Rohwer, 1930**

Ontario: **Thunder Bay**, 1♀, "Port Arthur" [= Thunder Bay], 26 August 1969, K.J.G. Deacon. **Carleton**, 1♀, Carp, 29 August 1975, D.J. Aspinall. **Leeds and Grenville**, 1♀, Greenbush, 22 August 1998, pasture, flight intercept trap, R. Hainault (CNCI); 1♀, St. Lawrence Is. National Park, McDonald I., 20 August 1976, Reid (CNCI); 1♀, same except Thwartway I. [= Leek I.], 11 August 1976 (CNCI). **Hastings**, 1♂, Marmora, 11 August 1952, swept from top of large basswood, J.F. McAlpine (CNCI); 1♂, Belleville, 26 July 1933, H.R. Boyce (CNCI). **Northumberland**, 2♂♂ 5♀♀, Murray Hills, 44°7'0"N, 77°40'0"W, 1 September 2002, yellow and white pans, S.M. Paiero. **Wentworth**, 1♂, Ancaster, 8 August 1969, J.E.H. Martin (CNCI). **Lincoln**, 1♂, Vineland, 6 July 1944, H.R. Boyce (CNCI); 1♂, same except 21 August 1972, emergence cage, E.A.C. Hagley (CNCI). **Essex**, 2♂♂, Windsor, Ojibway Prairie, nr. Sprucewood Avenue, 26-27 August 2002, yellow and white pans, M. Buck & S.M. Paiero.

Quebec: 1♀, Aylmer, 10 September 1893, "W.H.H." [= W.H. Harrington] (CNCI); 2♀♀, Mont St. Hilaire, 26 July-2 August 1977, A.T. Finnamore (LEMQ).

Distribution. Newly recorded for Canada (ON, QC). Eastern United States: NH to VA, IL, IA, MO (Krombein 1979).

Biology. Unknown (see below previous species).

***Didineis texana* (Cresson, 1872)**

Ontario: **Haldimand**, 1♂, Dunnville, 16 August 1983, M. Bottos. **Norfolk**, 1♀, Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 7 September 2001, sandy field, yellow pans, M. Buck & S.M. Paiero. **Essex**, 2♂♂, Harrow, 22 August 1974, J.T. Huber; Windsor, Ojibway Prairie, 1♀, 30-31 July 2002, yellow pans, S.M. Paiero & A. Staquet, 1♂, 12 September 2002, M. Buck.

Distribution. Newly recorded for Canada. Eastern U.S.: PA, NJ to FL, west to KS, MO, eastern AZ; northern Mexico (Krombein 1979). Harrington (1902) and Finnamore (1982) erroneously recorded this species from Quebec based on misidentified material of *D. latimana* (examined, see below that species).

Biology. Probably ground-nesting. *Cixius stigmatus* Say (Cixiidae) has been recorded as prey (Krombein 1979).

***Nyssan daeckei* Viereck, 1904**

Ontario: **Cochrane** 1♂ 1♀, Iroquois Falls, 22 June 1987, J.R. Vockeroth (CNCI). **Thunder Bay**, 1♂, Neys Provincial Park, 1.6 km SW of gate house, 48°46'39"N, 86°36'32"W, 8-19 July 2002, *Vaccinium*/lichen, yellow pans, M. Buck; 1♂ 8♀♀, 28 km E Nipigon, 48°58'0"N, 87°58'47"W, 8 July 2002, sandy area, M. Buck; 16♀♀, Sleeping Giant Provincial Park, 2.5 km S Visitor Centre, 9 July 2002, old sand pit, M. Buck; 3♀♀, Sleeping Giant Provincial Park, Tee Harbour, 48°19'32"N, 88°52'48"W, 12 July 2002, beach, M. Buck; 4♀♀, Thunder Bay, 13 km ENE Jct. Hwy 17 & 527, 48°31'37"N, 88°58'41"W, 10 July 2002, M. Buck; 1♀, Thunder Bay, 16 km ENE Jct. Hwy 17 & 527, 48°32'7"N, 88°56'23"W, 10 July 2002, M. Buck; 5♀♀, Terrace Bay, 15 July 2002, beach, M. Buck; 6♂♂ 1♀, Pukaskwa National Park, Beach Trail, 29-30 July 2003, dunes, yellow pans, S.M. Paiero. **Rainy River**, 1♂, 13 mi E Atikokan on Hwy 623, 4-5 July 1978, H.J. Teskey (CNCI). **Sudbury**, 3♀♀, 1 km W Webbwood, 20 July 2002, old sand pit, M. Buck. **Algoma**, 1♀, White River, 8 July 1977, D.H. Pengelly; Sault Ste. Marie, 1♀, 13 July 1963, D.B. Stoltz, 1♀, 3 July 1976, C.D. Neilsen. **Parry Sound**, 1♂, Powassan, 14 July 197?, G. Sevean; ♂, Killbear Provincial Park, 29 June 1979, W.A. Attwater. **Manitoulin**, Manitoulin I., Carter Bay, 45°36'23"N, 82°8'27"W, 7♂♂ 5♀♀, 23-24 June 2003, M. Buck & S.M. Paiero, 1♀, 10-19 July 2003, yellow pans, M. Buck, 1♀, 13 July 2003, M. Buck; Manitoulin I., Providence Bay,

45°39'41"N, 82°15'40"W, 1 ♀, 25 June 2003, S.M. Paiero, 1 ♂ 1 ♀, 26 June 2003, 1 ♀, 18 July 2003, dunes, M. Buck; Manitoulin I., Sand Bay, 45°48'6"N, 82°47'36"W, 3 ♀ ♀, 25 June 2003, M. Buck & S.M. Paiero, 3 ♀ ♀, 17 July 2003, M. Buck; 3 ♀ ♀, Manitoulin I., Shrigley Bay, 45°43'33"N, 82°29'5"W, 9 July 2003, M. Buck; 1 ♂ 3 ♀ ♀, Manitoulin I., Misery Bay Provincial Park, 45°47'37"N, 82°44'11"W, 12 July 2003, beach, M. Buck; 3 ♀ ♀, Manitoulin I., Union Road nr. Portage Lk., 45°46'5"N, 82°32'13"W, sandy field, 14 July 2003, M. Buck; 1 ♂ 2 ♀ ♀, Manitoulin I., Dominion Bay, 45°42'19"N, 82°24'30"W, dunes, 16 July 2003, M. Buck; 4 ♀ ♀, Manitoulin I., Square Bay, 45°42'0"N, 82°23'0"W, 19 July 2003, M. Buck; 1 ♀, Manitoulin I., Portage Bay, 45°45'0"N, 82°32'0"W, 21 July 2003, M. Buck. **Carleton**, 2 ♀ ♀, Ottawa, 15 and 22 June 1975, R.E. Roughley. **Bruce**, Dorcas Bay, 11 ♂ ♂ 7 ♀ ♀, 5-13 June 1999, dunes, malaise trap, S.A. Marshall, 1 ♀, 6 July 2000, S.M. Paiero; 1 ♀, Bruce Peninsula National Park, Singing Sands, 45°11'34"N, 81°34'58"W, 30 July 1997, wetland, malaise trap, S.A. Marshall, 2 ♂ ♂ 1 ♀, 8 July 2003, M. Buck; 1 ♀, Dyers Bay, 22 July 1956, D.H. Pengelly; 5 ♂ ♂ 2 ♀ ♀, Sauble Beach, 7 and 9 July 1981, G. Aiudi & J. Kircher; 2 ♀ ♀, Sauble Falls, 9 July 1981, C. Farivar; Inverhuron Provincial Park, 2 ♂ ♂, 15 June 2003, 4 ♂ ♂ 6 ♀ ♀ (3 ♂ ♂ 4 ♀ ♀ in yellow pans, 1 ♂ 1 ♀ in white pans), 2 July 2003, 5 ♀ ♀, 25 July 2003, dunes, M. Buck. **Bruce or Grey**, Hepworth, 1 ♀, 16 July 1974, R.E. Roughley, 2 ♀ ♀, 26 June 1975, J.T. Huber, 1 ♂, 31 May 1979, S.A. Marshall. **Grey**, 1 ♂, Durham, 17 June 1955, D.H. Pengelly; Hepworth dunes, 44°37'N, 81°9'W, 15 ♂ ♂ 14 ♀ ♀ (4 ♂ ♂ 2 ♀ ♀ in yellow pans, 1 ♀ in white pans), 5 July 2003, 1 ♀, 22 July 2003, M. Buck. **Simcoe**, 1 ♀, Midland, 23 June 1974, J.T. Huber. **Dufferin**, 3 ♀ ♀, Primrose, 17 July 1956 and 7 July 1960, D.H. Pengelly; 1 ♀, same except 8 July 1974, J.T. Huber. **Wellington**, 1 ♀, Guelph, 26 June 1956, D.H. Pengelly; 2 ♂ ♂ 3 ♀ ♀, Aberfoyle, 25 June 1956, D.H. Pengelly. **Halton**, 1 ♀, Milton, Woodland Trails Camp, 4th Line Nassagaweya, 43°22'51"N, 79°59'35"W, 16 July 2004, S.M. Paiero. **Brant**, 1 ♀, Brantford Railway Prairie, 43°10'N, 80°19'W, 12 July 2002, S.M. Paiero. **Norfolk**, Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 1 ♂, 30 June 2000, 8 ♂ ♂ 23 ♀ ♀ (1 ♀ in white pans), 8 June 2001, 4 ♀ ♀ (2 in white pans), 15 June 2001, 6 ♀ ♀ (2 in yellow pans), 25 June 2001, 5 ♂ ♂ 10 ♀ ♀, 23 June 2002, sandy field, M. Buck, 1 ♀, 15 June 2003, S.A. Marshall. **Elgin**, 1 ♀, Port Burwell, 4 July 1974, J.T. Huber. **Lambton**, 3 ♀ ♀ (1 in malaise trap), Port Franks, Watson Property nr. L-Lake, 27 June-2 July 1996, J. Skevington.

Distribution. Newly recorded for Ontario. Canada: AB; eastern U.S.: IA, MI, NY, PA, MA, NJ (Krombein 1979). The species also occurs in NS, NB, QC, MB and SK (Buck, in prep.).

Biology. Cleptoparasitic on *Gorytes canaliculatus* and *Hoplisoides nebulosus* (Bohart and Menke 1976). Because of previous confusion between *H. nebulosus* and *H. placidus pergandei* the second host needs to be confirmed. Primary host in Ontario is undoubtedly *G. canaliculatus* (Buck, unpubl.).

Nyssus gagates Bradley, 1920

Ontario: Thunder Bay, 7 ♂ ♂ 6 ♀ ♀, Little Pic River at Hwy 17, 48°48'5"N, 86°37'47"W, 15 and 17 July 2002, sand cliff, M. Buck; 5 ♀ ♀, Neys Provincial Park, railway crossing, 48°46'30"N, 86°35'3"W, 17-18 July 2002, M. Buck; 1 ♂ 3 ♀ ♀, Neys Provincial Park, 1.6 km SW of gate house, 48°46'39"N, 86°36'32"W, 8-19 July 2002, *Vaccinium*/lichen, yellow pans, M. Buck; 1 ♂ 3 ♀ ♀, 28 km E Nipigon, 48°58'0"N, 87°58'47"W, 8 July 2002, M. Buck; Sleeping Giant Provincial Park, 2.5 km S Visitor Centre, 48°20'53"N, 88°48'11"W, old sand pit, 3 ♂ ♂ 4 ♀ ♀, 9 July 2002, 4 ♀ ♀, 14 July 2002, M. Buck; 5 ♂ ♂ 3 ♀ ♀, Sleeping Giant Provincial Park, Marie Louise Campground, 9-14 July 2002, white pans, M. Buck; 3 ♀ ♀, Thunder Bay, 16 km ENE Jct. Hwy 17 & 527, 48°32'7"N, 88°56'23"W, 10 July 2002, M. Buck. **Rainy River**, 1 ♂, Rainy River, 5 July 1960, S.M. Clark (CNCI). **Carleton**, 1 ♀, "621", "1431", Provancher collection (Provancher 1887, as *N. rusticus*; Ottawa, leg. Guignard) (ULQC); 1 ♂, "Flats 11.7", 1 ♂, "Ar. 20.6", 1 ♀, "*Nyssus rusticus*

Cress. Sh. 19.7.85", probably collected by Guignard (i.e. probably from the Ottawa region or nearby Quebec) (CNCI). **Prince Edward**, 1♂, Smith Bay nr. Picton, 1 July 1970, J.F. McAlpine (CNCI). **Northumberland**, 1♀, Brighton, 17 July 1956, malaise trap, no collector (CNCI). **Bruce**, 5♀♀, Inverhuron Provincial Park, front dunes, 44°17'33"N, 81°35'28"W, 10 September 2003, white and yellow pans (excl. 1♀), M. Buck & S.M. Paiero. **Dufferin**, 1♂, Primrose, 17 July 1956, D.H. Pengelly. **Wellington**, 1♀, Guelph, 14 August 1961, G.P. Brumpton. **Norfolk**, Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 1 ♀, 24 August 2001, yellow pans, 3♂♂, 23 June 2002, sandy field, M. Buck.

Distribution. Newly recorded for Ontario. Canada: BC; U.S.: NY, MS (Krombein 1979). The species also occurs in QC, MB, SK, AB and YT (Buck, in prep.).

Biology. Unknown.

Taxonomy. See below *Nysson trichrus* (Mickel) in the section on species erroneously recorded from Ontario (p.76).

Nysson hesperus Bohart, 1968

Ontario: Algoma, 1♂, Hilton Beach, 24 August 1992, field, malaise trap, J.E. Swann. **Hastings**, 1♀, Trent River Prairie [NE of Stirling], top of Old Man's Hill, 44°13'N, 77°34'W, 23 August 1994, J.T. Kerr & L. Packer (LPC). **Brant**, 1♀, Brantford Railway Prairie, 43°10'N, 80°19'W, 24 July 2002, M. Buck.

Distribution. Newly recorded for Ontario. Canada: BC; western U.S.: WY, CO, ID, OR, NV, CA (Krombein 1979). The species also occurs in NB, MB, SK, BC, YT and NT (Buck, in prep.).

Biology. Unknown.

Nysson simplicicornis Fox, 1896

Ontario: Brant, Brantford Railway Prairie, 43°10'N, 80°19'W, 1♂, 24 August 2001, yellow pans, 1♂, 12 July 2002, S.M. Paiero, 2♀♀, 24 July 2002, M. Buck & S.M. Paiero. **Essex**, 1♀, Windsor, Ojibway Prairie, 30 July 2002, on earth between roots of fallen tree, M. Buck.

Distribution. Newly recorded for Canada. U.S.: NY, PA, MI, MD, DC, VA, WV, IA, NE, MO (Krombein 1979).

Biology. Unknown.

Nysson subtilis Fox, 1896

Ontario: Leeds and Grenville, 1♀, St. Lawrence Is. National Park, Thwartway I. [= Leek I.], 5 August 1976, Reid (CNCI). **Peterborough**, ♂, Methuen Township, Sandy Lake Road, 9 June 2001, W.J. Crins. **York**, 1♀, Toronto, 1-2 July 1978, R.S. Peigler (TAMU). **Lambton**, 1♀, Port Franks, Karner Blue Sanctuary, 18-22 July 1996, malaise trap, J. Skevington; 2♀♀, Port Franks, Watson Property nr. L-Lake, 15-22 July 1996, malaise trap, J. Skevington. **Essex**, Windsor, Ojibway Prairie, 2♀♀, 15-19 June 2001, 1♀, 19-22 June 2001, 1 ♀, 25-29 June 2001, 1♀, 29 June-3 July 2001, 1♀, 10-13 July 2001, burnt savannah, yellow pans, S.M. Paiero, 18♂♂ 4♀♀, 18-19 June 2002, M. Buck & S.M. Paiero; 1♀, 20 July 2002, S.A. Marshall.

Distribution. Newly recorded for Canada. Eastern U.S.: NY, PA, NJ, MD, DC, WV (Krombein 1979). The species also occurs in Quebec (Buck, in prep.).

Biology. Unknown.

***Synnevrus aequalis* (Patton, 1879)**

Ontario: Essex, 1 ♂, Point Pelee, 22 July 1979, J.M. Heraty.

Distribution. Newly recorded for Canada. Eastern U.S.: MA south to FL, WI, IA, IL, SD, LA (Krombein 1979).

Biology. Unknown. Probably cleptoparasitic on other Sphecidae/Crabronidae.

***Synnevrus plagiatus* (Cresson, 1882)**

Ontario: Simcoe, 4♂♂ 1 ♀, Midland, 17 July 1977, A. Konecny. **York,** Toronto, 1♂, July 1924, R.W. Hall, 1♂, 27 July 1953, M.E. Hearst (both ROME). **Wentworth,** 1♀, Ancaster, 26 July 1955, J.E.H. Martin (CNCI). **Middlesex,** 1♀, Strathroy, 28 July 1919, H.F. Hudson (CNCI). **Kent,** Rondeau Provincial Park, South Point Trail East, 1♂ 4♀♀, 9-10 August 2003, dunes and savannah, yellow and white pans, M. Buck, 3♀♀, 16 August 2003, S.M. Paiero, 6♀♀ (3♀♀ in yellow pans), 5-7 September 2003, Carolinian forest, dunes and savannah, M. Buck. **Essex,** Point Pelee, 2♀♀, 25 August 1920, N.K. Bigelow (ROME), 1♀, 20 July 1978, 1♂ 1♀, 25 July 1979, W.A. Attwater, 1♀, 25 July 1979, D. Morris, 1♂, 19 July 1978, K.N. Barber; 1♂, Point Pelee National Park, Visitor Centre, 25 July 2003, D. Cheung; Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 1♀, 14-15 August 2003, yellow pans, M. Buck & D. Cheung, 1♀, 30 July 2003, 2♀♀, 14 August 2003, M. Buck; Point Pelee National Park, *Opuntia* field N of Visitor Centre, 1♂, 24-25 July 2003, yellow pans, D. Cheung & S.M. Paiero, 1♂ 2♀♀, 25-30 July 2003, yellow pans, S.M. Paiero & D. Cheung; 1♀, Point Pelee National Park, De Laurier House, 29-30 July 2003, yellow pans, M. Buck & D. Cheung.

Distribution. Newly recorded for Ontario. Canada: QC (Finnamore 1982); U.S. east of Rocky Mts. (Krombein 1979).

Biology. Evans (1975a) reared this cleptoparasitic species from cells of *Sphex ichneumoneus* (L.).

***Epinysson mellipes* (Cresson, 1882)**

Ontario: Leeds and Grenville, 1♂, St. Lawrence Is. National Park, Grenadier I. Centre, 18 July 1975, E. Sigler (CNCI). **Dufferin,** 1♂, Boyne Valley Provincial Park, 1 km N Primrose, 44°6'15"N, 80°8'0"W, 27 July 2002, yellow pans, M. Buck. **York,** Toronto, 1♂, 1 July 1891, 3♂♂ 1♀, 5 July 1891, no collector (labels in W.N. Brodie's handwriting and style) (CNCI). **Wellington,** Guelph, 1♂, 20 July 1974, J.T. Huber, 1♂, 14 May 1977, W.A. Attwater. **Wentworth,** 1♀, Ancaster, 30 July 1979, L. Templin. **Welland,** 1♀, Niagara Whirlpool, 1 July 2004, S.M. Paiero. **Brant,** Brantford Railway Prairie, 43°10'N, 80°19'W, 2♂♂ 1♀, 12 July 2002, yellow pans (excl. 1♂), S.M. Paiero, 5♂♂ 4♀♀, 24 July 2002, S.M. Paiero & M. Buck. **Norfolk,** 1♀, Turkey Point Tract at Regional Road 10, 42°42'2"N, 80°20'17"W, 23 August 2003, yellow pans, M. Buck. **Kent,** 1♂, Rondeau Provincial Park, South Point Trail East, 42°15'35"N, 81°50'53"W, 9-10 August 2003, savannah, white pans, M. Buck. **Essex,** 3♀♀, Windsor, Ojibway Prairie nr. Sprucewood Avenue, 26-27 August 2002, white and yellow pans, M. Buck & S.M. Paiero.

Distribution. Newly recorded for eastern Canada. Canada: BC; U.S.: NH to FL, LA, MN, IA, ND, CO, MT, CA (Krombein 1979). The species also occurs in Manitoba (Buck, in prep.).

Biology. Unknown.

***Epinysson tramosericus* (Viereck, 1904)**

[= *E. basilaris tuberculatus* auctt., nec Handlirsch, 1887]

Ontario: Nipissing, 1♀, Algonquin Provincial Park, Lake Travers Road NE km 36.5, 45°54'1"N, 77°42'45"W, 18 August 2002, M. Buck. **Victoria,** 1♀, Coboconk, 18 July 1961, G.K. Morris. **Grey,** Hepworth dunes, 44°37'N, 81°9'W, 8♂♂ 7♀♀ (6 ♂♂ in yellow pans, 1 ♀ in

white pans), 5 July 2003, 1 ♀, 22 July 2003, M. Buck. **Dufferin**, 1 ♂, Orangeville, 9 July 1954, D.H. Pengelly. **Halton**, 1 ♀, Milton, Woodland Trails Camp, 4th Line Nassagaweya, 43°32'51"N, 79°59'35"W, 18 August 2003, M. Buck. **Welland**, 1 ♀, Niagara Whirlpool, 1 July 2004, S.M. Paiero. **Brant**, 3 ♂♂ 2 ♀♀, Brantford Railway Prairie, 43°10'N, 80°19'W, 12 July 2002, yellow pans (excl. 1 ♂), S.M. Paiero. **Norfolk**, 2 ♂♂, Manestar Tract, 6 km NNW St. Williams, 23 June 2002, sandy field, M. Buck; 1 ♂, Normandale, 30 June 1956, C.D. Miller (CNCI); 1 ♀, Normandale Fish Culture Station, 42°43'7"N, 80°20'20"W, 23 August 2003, M. Buck. **Lambton**, Pinery Provincial Park, 1 ♂, 11-14 June 1986, malaise trap, 1 ♀, 18-21 June 1986, power line, malaise pans, L. Packer (LPC); Port Franks, Watson Property nr. L-Lake, 2 ♂♂ 1 ♀, 12-15 July 1996, 2 ♀♀, 22-28 July 1996, malaise trap, J. Skevington; 1 ♀, Port Franks, Karner Blue Sanctuary, 18-25 July 1996, pan traps, J. Skevington. **Kent**, 1 ♂, Rondeau Provincial Park, 21 June 1962, S.M. Clark (CNCI). **Essex**, Windsor, Springarden Road ANSI, 1 ♂ 8 ♀♀, 31 July 2002, M. Buck & S.M. Paiero, 2 ♀♀, 27 August 2002, M. Buck.

Distribution. Newly recorded for Canada. Eastern U.S.: NY, PA west to WI, ND, south to SC (Krombein 1979). The species also occurs in Manitoba (Buck, in prep.).

Biology. The host of this species has been recorded as *Hoplisoides nebulosus* (Krombein 1979). Due to previous confusion of this species with *H. placidus pergandei* the host association needs to be confirmed.

Taxonomy. This species has previously gone under the name *E. basilaris tuberculatus* (Handlirsch). Examination of the type of *tuberculatus* Handlirsch revealed that it is conspecific with *hoplisivora* Rohwer and takes priority over this name (Buck, in prep.). *E. tramosericus* has also been frequently confused with the southern Nearctic *E. opulentus* (Gerstaecker), a species erroneously recorded from Ontario (see page 76 below). The taxonomy of *Epinysson* will be dealt with in a separate review (Buck, in prep.).

Epinysson tuberculatus (Handlirsch, 1887)

[= *E. guatemalensis hoplisivora* (Rohwer, 1923)]

Ontario: **Brant**, 2 ♂♂, Brantford Railway Prairie, 43°10'N, 80°19'W, 12 July 2002, S.M. Paiero. **Norfolk**, Turkey Point Tract at Regional Road 10, 42°42'2"N, 80°20'17"W, 1 ♀, 17 August 2003, netted, 1 ♀, 23 August 2003, yellow pans, M. Buck. **Lambton**, 1 ♂, Walpole I., 12 July 1979, W.A. Attwater; 1 ♂, Port Franks, Watson Property near lake, 7-14 August 1996, malaise trap, J. Skevington. **Kent**, Rondeau Provincial Park, South Point Trail east, savannah, 1 ♀, 7 September 2002, yellow pans, 4 ♀♀ (1 ♀ in white pans), 9-10 August 2003, 1 ♀, 5-7 September 2003, yellow pans, M. Buck; 1 ♂ 1 ♀, Rondeau Provincial Park, Lakeshore Road, Beach Access #11, 42°16'1"N, 81°50'39"W, dunes, M. Buck. **Essex**, Point Pelee, 1 ♂, 18 July 1978, D. Morris, 1 ♂ 2 ♀♀, 20 July 1978, W.A. Attwater, 2 ♀♀, 21 July 1979, J.M. Heraty; 3 ♂♂, Point Pelee National Park, West Beach, 13-14 August 2003, M. Buck; 2 ♂♂, Point Pelee National Park, Visitor Centre, 17-18 July 2003, yellow pans, D. Cheung; Point Pelee National Park, *Opuntia* field N of Visitor Centre, 3 ♀♀, 11-17 July 2003, yellow pans, D. Cheung, 9 ♀♀, 24-30 July 2003, yellow and white pans, D. Cheung & S.M. Paiero; 3 ♀♀, Point Pelee National Park, De Laurier House, 29-30 July 2003, white pans, M. Buck & D. Cheung; Windsor, Ojibway Prairie, 2 ♂♂ 1 ♀, 30 July 2002, 1 ♀, 26 August 2002, netted, M. Buck & S.M. Paiero, 2 ♀♀, 26-27 August 2002, sandy savannah, yellow pans, M. Buck, 4 ♂♂ 2 ♀♀, 25 July 2003, yellow pans, S.M. Paiero.

Distribution. Newly recorded for Canada. Eastern U.S.: MD to FL (Krombein 1979).

Biology. Cleptoparasitic on *Hoplisoides costalis* (Cresson) (Krombein 1979).

Taxonomy. This distinct species was previously known under the synonym *E. guatemalensis hoplisivora* (Rohwer 1923) (Buck, in prep.; see under previous species). *Epinysson tuberculatus* (Handlirsch 1887) takes priority over both *hoplisivora* Rohwer and *guatemalensis* Rohwer 1914.

Clitemnestra bipunctata (Say, 1824)

Ontario: **Nipissing**, 1 ♀, Algonquin Park, Cache Lake, 31 July 1936 (ROME). **Parry Sound**, 1 ♀, Parry Sound, 20 July 1958, D.H. Pengelly. **Carleton**, Ottawa, 1 ♂, 22 June 1989, 2 ♀♀, 21 July and 6 August 1996, damp second growth *Acer-Betula* wood, J.R. Vockeroth (CNCI). **Bruce**, 1 ♂, Dyers Bay, 30 July 1953, D.H. Pengelly. **Peel**, Forks of the Credit, gravel pit NW of Provincial Park, 43°49'24"N, 80°0'57"W, 10 ♂♂, 3 and 5 August 2002, M. Buck. **Wellington**, 1 ♀, Guelph, 6 July 2003, on outside window in city, M. Buck. **Halton**, 1 ♀, Oakville, 2 July 2002, S.M. Paiero; Milton, Derry Road & 4th Line, 43°31'31"N, 79°50'25"W, 1 ♀, 14 July 2002 1 ♀, 30 August 2002, S.M. Paiero; 1 ♀, Milton, 16 Mile Creek & 4th Line, 43°29'5"N, 79°46'27"W, 12 August 2001, river valley, S.M. Paiero; Oakville nr. Hwy 25 & Burnhamthorpe Road, 1 ♀, 14-18 August 1999, 1 ♀, 21 July 2002, 4 ♀♀*, 16 August 2002, 1 ♀, 9-10 August 2003, S.M. Paiero. **Wentworth**, 3 ♀♀, Hamilton, 23-30 August 1981, M. Sanborne (CNCI); 1 ♀, Dundas, 7-11 August 1972, D.M. Wood (CNCI); 1 ♂, Flamborough, Lawson Farm, 18-25 July 1997, alvar, B. DeJonge. **Welland**, 1 ♀, Niagara Falls, 22 June 1957, no collector (CNCI). **Lincoln**, 1 ♀, Grimsby, 6 July 1894, no collector (CNCI). **Brant**, Brantford Railway Prairie, 43°10'N, 80°19'W, 1 ♀, 12 July 2002, S.M. Paiero, 1 ♂ 22 ♀♀, 24 July 2002, M. Buck & S.M. Paiero. **Kent**, 1 ♀, Wheatley, 15 August 1982, T.D. Galloway (EDUM). **Essex**, 3 ♂♂ 1 ♀, Leamington, 17 August 1987, T.D. Galloway (EDUM); 1 ♀, Windsor, Ojibway Prairie, 12-13 September 2002, on earth between roots of fallen tree, S.M. Paiero.

Distribution. Genus and species newly recorded for Ontario. Canada: AB (Strickland 1947), QC (Finnamore 1982); U.S.: Upper and Lower Austral Zones (Krombein 1979).

Biology. Nesting in sandy or heavier soil. Prey are adult or more rarely nymphal Cicadellidae, Cercopidae, Membracidae, Cixiidae and Psyllidae (Krombein 1979).

Prey record. *) One adult *Ponana quadralabra* DeLong (Cicadellidae).

Argogorytes nigrifrons (Smith, 1856)

Ontario: **Leeds and Grenville**, St. Lawrence Is. National Park, Grenadier I. Centre, 2 ♀♀, 14 July 1975, 1 ♀, 18 July 1975, 1 ♀, 23 July 1975, 1 ♀, 21 July 1975, E. Sigler (CNCI). **Hastings**, 1 ♀, Belleville, 28 July 1949, E.J. Bond. **Simcoe**, 1 ♀, Midland, 17 July 1977, A. Konecny. **Kent**, 1 ♀, Rondeau Provincial Park, 18 July 1962, S.M. Clark (CNCI).

Distribution. Newly recorded for Ontario. Canada: QC (Finnamore 1982), NS; eastern U.S.: New England states south to GA and west to WI, IA, KS, TX (Krombein 1979).

Biology. Unknown. Two Palearctic species nest in the ground and use nymphal spittlebugs as prey (Krombein 1979).

Lestiphorus cockerelli (Rohwer, 1909)

Ontario: **Thunder Bay**, 1 ♀, Lake Nipigon, Macdiarmid, 16 July 1922 N.K. Bigelow (CNCI). **Leeds and Grenville**, 1 ♀, Spencerville, 29 August 1938, G.H. Hammond (CNCI). **Hastings**, 1 ♀, Trent River Prairie [NE of Stirling], top of Old Man's Hill, 44°13'N, 77°34'W, 23 August 1994, J.T. Kerr & L. Packer (LPC). **Northumberland**, 1 ♀, Murray Hills, 44°7'N, 77°40'W, 1 September 2002, S.M. Paiero. **Bruce**, 1 ♀, Dyers Bay, 20 July 1953, D.H. Pengelly. **Wellington**, 1 ♀, Guelph, 23 August 1982, A.W. Schaafsma.

New Brunswick: 1 ♀, Bailey, 6 September 1977, S.M. Smith.

Distribution. Genus and species newly recorded for Ontario and New Brunswick. Canada: NT (Steiner 1973), QC (Finnamore 1982); U.S.: PA (Kurczewski and Miller 1991), MA, NY, MI, SD, CO (Krombein 1979).

Biology. Nesting habits unknown. Prey are adult *Acanalonia bivittata* (Say) (Issidae) (Kuczewski and Miller 1991).

***Oryttus gracilis* (Patton, 1879)**

Ontario: Essex, 1♂, Point Pelee, 12 July 1920, N.K. Bigelow (ROME).

Distribution. Genus and species newly recorded for Canada. U.S. east of 100th meridian in Upper and Lower Austral Zones (Krombein 1979).

Biology. Unknown. Other *Oryttus* species prey on Fulgoridae and Cicadellidae (Krombein 1979).

***Hoplisoides costalis* (Cresson, 1872)**

Ontario: Carleton, 1♀, Ottawa, 5 August 1989, damp second-growth *Acer-Betula* wood, J.R. Vockeroth (CNCI). **Huron**, 1♀, "Godrich" [= Goderich], 9 September (no year), D. Maize. **York**, 2♀♀, Toronto, 16 and 24 July 1981, L. Packer (LPC, DEBU). **Wellington**, 1♀, Guelph, August 1964, I. Kukovica. **Halton**, 1♀, Milton, downtown, 20 August 2002, on *Campsis* flowers, S.M. Paiero; 1♀, Milton, Derry Road & 4th Line, 43°31'31"N, 79°50'25"W, 1 August 2002, S.M. Paiero; 1♀, Oakville, nr. Hwy 25 & Burnhamthorpe Road, 43°27'14"N, 79°47'32"W, 4 August 2002, S.M. Paiero. **Wentworth**, 2♀♀, Hamilton, 24 and 28 July 1980, M. Sanborne (PMAE). **Norfolk**, 1♀, Turkey Point area, 7 July 2002, B. Arnal & H. Duggan (BAR). **Lambton**, 1♀, Port Franks, Watson Property nr. L-Lake, 25-31 July 1996, malaise trap, J. Skevington. **Kent**, 1♀*), Rondeau Provincial Park, Spicebush Trail, 42°18'9"N, 81°51'6"W, Carolinian forest, 15 August 2003, nesting in sand between roots of fallen tree, S.M. Paiero. **Essex**, Point Pelee, 1♂, 9 July 1962, S.M. Clark (CNCI), 1♂, 18 July 1978, D. Morris; 1♀, Point Pelee National Park, West Beach, 13 August 2003, M. Buck.

Distribution. Newly recorded for Canada. Eastern U.S.: NY to NE, south to MO and FL; Mexico: Tamaulipas to Yucatán (Bohart 1997).

Biology. Nests in sand. Adult Membracidae of various genera are used as prey (Krombein 1979).

Prey record. *) Two adults of *Telamona* sp. (Membracidae) were brought in consecutively by presumably the same female.

***Hoplisoides placidus pergandei* (Handlirsch, 1888)**

[= *H. placidus nebulosus* auctt., nec Packard, 1867]

Ontario: Carleton, 1♀, locality not stated [= Ottawa area], "18/7", W.H. Harrington (CNCI). **Peterborough**, 1♀, Norwood, 6 August 1983, T.D. Galloway (EDUM). **Grey**, Hepworth dunes, 44°37'N, 81°9'W, 2♂♂ 7♀♀, 5 July 2003, 1♀, 22 July 2003, M. Buck. **Simcoe**, 1♀, Baxter, Six Mile Lake, 8 July 1981, L. Packer (LPC); 1♀, Christian I., 13 July 2002, A. Cormier. **Brant**, Brantford Railway Prairie, 43°10'N, 80°19'W, 1♂ 3♀♀, 12 July 2002, S.M. Paiero, 1♀, 24 July 2002, M. Buck. **Norfolk**, 16♂♂ 17♀♀, Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, various dates, June-July, 2000-2002, M. Buck; 1♀, Normandale Fish Culture Station, 42°43'7"N, 80°20'20"W, 23 August 2003, M. Buck. **Lambton**, 1♀, Port Franks, Karner Blue Sanctuary, 15 July 1996, J. Skevington; 1♀, Pinery Provincial Park, Carolinian Trail parking lot, grassy sandy area, 26 July 2001, M. Buck; Pinery Provincial Park, power line, 1♂, 14-17 June 1986, 1♂ 1♀, 18-21 June 1986, malaise trap, L. Packer (LPC, 1♂ DEBU). **Kent**, 1♀, Rondeau Provincial Park, Harrison Trail nr. group campground, 42°17'56"N, 81°50'48"W, 14 August 2003, forest clearing, S.M. Paiero. **Essex**, Windsor, Springarden Road ANSI, 3♀♀, 31 July 2002, M. Buck, 1♀, 27 August 2002, S.M. Paiero.

Quebec: 1♀, Lanoraie, 4 August 1928, J.W. Buckle (LEMQ); 1♀, St. Anne's, 5 August 1938 (LEMQ); 1♀, 3 mi N Ste. Scholastique, 13 July 1972, C. Boyle (LEMQ).

Distribution. Newly recorded for Canada (ON, QC). Eastern U.S. (Krombein 1979, partim). The nominate subspecies occurs in Florida (Krombein 1979).

Taxonomy. This subspecies of *H. placidus* was previously confused with *H. nebulosus*, which is a good species and not a subspecies of the former. The taxonomic changes in *Hoplisoides* will be presented in a separate review of that genus (Buck, in prep.).

Biology. Nests in sand and preys on Membracidae, like the closely related *H. nebulosus*. Due to confusion with this species previous prey records (e.g., Krombein 1979) need to be re-examined.

Stizoides renicinctus (Say, 1823)

Ontario: Middlesex, 1♂, London, no date, "Ent. Soc. O."

Distribution. Newly recorded for eastern Canada. Canada: southern AB and BC; U.S.: mainly west of Mississippi River, rare in east: MN, IL, WI, MI (Midland County and Benzie County), DC, NC; Mexico: Zacatecas (Ohl 1999).

Biology. Cleptoparasitic on *Prionyx atratus* (Lepeletier) and *P. thomae* (F.) (Sphecinae) (Krombein 1979). Only the former species occurs in southwestern Ontario.

Note. As can be inferred from the old Entomological Society of Ontario label this specimen must have been collected during the second half of the 19th century (the Society was founded in 1863). It appears to be one of the oldest sphecid specimens in the Guelph collection. Due to prevailing labelling standards at the time one cannot be completely certain that the specimen actually originated from London, Ontario. London was also the former seat of the Entomological Society and labels sometimes indicated ownership rather than collecting data. Considering the known range of the species it seems perfectly possible that the specimen was collected in or around London. Given the rarity of this species in eastern north America, its specialized biology, and the absence of recent records it appears very likely that *S. renicinctus* has been extirpated in Ontario some time ago.

Bicyrtes quadrifasciatus (Say, 1824)

Ontario: Frontenac, 1♀, Perth Road, 25 August 1957, J.R. Vockeroth (CNCI). **Northumberland,** 5♂♂ 3♀♀, Brighton, 7-8 August 1956, malaise trap, no collector (CNCI). **Bruce,** Inverhuron Provincial Park, dunes, 3♂♂ (1 in yellow pans), 26 July 2003, 1♀, 22 August 2003, M. Buck, 3♀♀, 10 September 2003, M. Buck & S.M. Paiero. **Simcoe,** 1♀, Springwater Provincial Park, hydro line, 44°26'33"N, 79°45'41"W, 2 September 2002, M. Buck. **Brant,** 1♂ 2♀♀¹), Brantford Railway Prairie, 43°10'N, 80°19'W, 24 July 2002, M. Buck & S.M. Paiero. **Norfolk,** 2♀♀, Simcoe, 19 July 1977, A.A. Konecny; Delhi-Simcoe Railway, 42°51'N, 80°23'W, 1♂, 11 July 2001, 1♂, 14 July 2001, prairie remnant, S.M. Paiero; Manestar Tract, 6 km NNW St. Williams, 42°42'17"N, 80°27'38"W, 3♂♂ 2♀♀, 25 July 2000, 1♂ 2♀♀²), 3 August 2001, M. Buck, 2♀♀³), 24 August 2001, sandy field, M. Buck & S.A. Marshall; 2♀♀, Wilson Tract, 9 July 1992, J. Skevington; 1♀, same data except 18 September 1991, I.P. Smith; 1♂, Normandale Fish Culture Station, 42°43'7"N, 80°20'20"W, 23 August 2003, M. Buck; 2♂♂, Long Point, 5 August 1978, W.D. Husby. **Lambton,** 3♂♂ 2♀♀, Grand Bend, A.A. Wood & C.D. Miller (CNCI); 1♀, Pinery Provincial Park, Grand Bend, 15 August 1982, K.N. Barber; Pinery Provincial Park, 1♀, 28 June 1991, malaise trap, 1♀, 9 September 1992, J. Skevington; 1♀, Pinery Provincial Park, Day Use Area 1, 43°17'8"N, 81°48'7"W, dunes, 27 July 2001, M. Buck; 2♀♀, Pinery Provincial Park, amphitheatre, 26 July 2001, sandy area, M. Buck. **Kent,** 6♂♂ 4♀♀, Rondeau Provincial Park, 1962, S.M. Clark (CNCI); 1♀, Rondeau Provincial Park, South Point Trail, 7 September 2002, M. Buck; 1♀, Chatham, 5 August 1947, no collector; 6♂♂, Wheatley, 9 July 1977, A.A. Konecny, E.A. Innes & W.A. Attwater. **Essex,** 1♀, Kingsville, 12 August 1973, R.E. Roughley; 1♂, Windsor, 10 June 1984, M.T. Kasserra; 18♂♂ 9♀♀, Point Pelee, July-August, 1978-1998, various

collectors; 1♂ 3♀♀, Point Pelee, S.M. Clark & R. Lambert (CNCI); 1♀, Point Pelee National Park, *Opuntia* field, 28 July 2003, M. Buck; Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 1♂ 1♀, 29 July 2003, 1♀, 14 August 2003, D. Cheung; 1♂, Point Pelee National Park, Old Henry Camp, 41°57'35"N, 82°31'32"W, 14-15 August 2003, white pans, M. Buck & D. Cheung; 1♀⁴), Pelee I., 29 August 1977, W.D. Husby; Pelee I., Fish Point, 3♀♀, 5 August 1993, R.A. Cannings & H. Nadel (BCPM), 1♀, 14 August 1993, B. Larson; Windsor, Ojibway Prairie, 1♀, 30-31 July 2002, S.M. Paiero, 1♀, 26 August 2002, M. Buck; 1♀, Windsor, Springarden Road ANSI, 31 July 2002, M. Buck.

Distribution. Apparently, this species has never been formally recorded from Canada. U.S. east of Rocky Mts. in Transitional and Austral Zones (Krombein 1979).

Biology. Nests in sand or heavier soil. Immature Pentatomidae and Coreidae are used as prey (Krombein 1979).

Prey records. ¹) and ²) One nymphal *Leptoglossus occidentalis* Heidemann (Coreidae) each. ³) One nymphal *Leptoglossus occidentalis* and one nymphal *Acrosternum* sp. (Pentatomidae). ⁴) One nymphal *Acrosternum* sp.

Nomenclature. Contrary to prevalent previous usage (e.g., Krombein 1979, Bohart 1996) the gender of *Bicyrtes* is masculine (Pulawski 2004).

Stictia carolina (Fabricius, 1793)

Ontario: Essex, 1♂, Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 14 August 2003, M. Buck.

Distribution. Newly recorded for Canada. Eastern U.S.: NJ to FL, west to IL, KS, NM (Krombein 1979).

Biology. Nests in sand, occasionally in large aggregations. Prey are large flies of various families (predominantly Tabanidae, also Stratiomyidae, Syrphidae, Muscidae, Sarcophagidae, Calliphoridae, Tachinidae), exceptionally other insects (Cicadidae, Hesperidae) (Krombein 1979). The species is also called "horse guard" because it often hunts its prey around livestock.

Note. It is remarkable that this very large and conspicuous wasp has not been found during previous insect surveys of Point Pelee (conducted in 1920 (N.K. Bigelow), in 1978/9 and 1999/2000 (University of Guelph)). This could indicate that the species recently expanded its range or that the collected male was merely a straggler. The site where the specimen was found is not a suitable breeding habitat but possible breeding sites might exist nearby along the Lake Erie shore.

Stictiella emarginata (Cresson, 1865)

Ontario: Simcoe, C.F.B. Borden, 1♀, 26 July 1996, 1♀, 13 July 1997, F.E. Kurczewski (FEK). **Dufferin,** Primrose, 1♀, 30 June 1955, 1♀, 22 July 1955, 1♀, 17 July 1956, D.H. Pengelly. **York,** 1♂, Toronto, August 1918, no collector (CNCI).

Saskatchewan: 1♂, Nipawin, 14 July 1968, T.C. Taylor; 1♀, Meadow Lake, 20 June 1977, W.T. Nash; 1♀, Melville, 3 July 1979, D.H. Pengelly; 1♂, Prince Albert, 22 July 1916, F.W.L. Sladen (CNCI).

Distribution. Newly recorded for Ontario and Saskatchewan. Canada: AB; U.S.: NY south to northern FL (along the Appalachian Mts.), MI, MN, IA, and from KS and TX west to WA and CA (Bohart and Gillaspay 1985; O'Brien 1989a). The species is rare in the eastern part of its range.

Biology. Preys upon adult Lepidoptera of the genera *Apamea*, *Calophasia*, *Chytonix*, *Euxoa*, *Lacinipolia*, *Nedra* (Noctuidae) and *Polites* (Hesperiidae) (Kurczewski, *in litt.*).

Subfamily Philanthinae

Philanthus lepidus Cresson, 1865

Ontario: **Manitoulin**, 1♂, Manitoulin I., Carter Bay, 45°36'23"N, 82°8'27"W, 28 August 2003, dunes, S.A. Marshall. **Leeds and Grenville**, 1 specimen (digital picture of live specimen), Charleston Lake, 2002/3, H. Goulet (picture in collection of H. Goulet). **Hastings**, Marmora, 1♂, 29 July 1952, 1♀, 6 August 1952, C. Boyle (CNCI); Chatterton, 1♂, 14 August 1948, 2♂♂, 25 August 1949, J.C. Martin (CNCI); 1♀, Belleville, 3 August 1946, no collector (CNCI). **Peterborough**, 1♂, Norwood, 16 August 1984, T.D. Galloway (EDUM). **Northumberland**, 1♀, Brighton, 14 September 1954, J.C. Martin (CNCI); 1♀, Alderville First Nations Prairie and Savannah, 1 September 2001, S.M. Paiero. **Bruce**, Inverhuron Provincial Park, 1♂, 22 August 2003, 2♂♂, 10 September 2003, dunes, M. Buck. **Dufferin**, 1♂, Mansfield Outdoor Centre, 19-20 September 1992, J. Skevington & A. Goering; 2♂♂ 3♀♀¹⁾, Mono Cliffs Provincial Park, 31 August 2002, M. Buck. **Wellington**, 1♀, Guelph, 13 September 1992, R.W. Burgess. **Wentworth**, 2♀♀, Hamilton, 23-30 August 1981, M. Sanborne (CNCI). **Norfolk**, 1♂, Turkey Point Provincial Park, 11 August 1984, L. Packer (LPC); 1♂, St. Williams, 6 August 1986, L. Packer (LPC); 3♂♂ 1♀, Normandale Fish Culture Station, 42°43'7"N, 80°20'20"W, 23 August 2003, M. Buck; 1♂, St. Williams Forestry Station, 5 September 1987, J.T. Troubridge; 2♀♀, Manestar Tract, 42°43'N, 80°27'W, 20-26 August 1993, oak savannah, malaise trap, J.T. Kerr, M. deGiusti & L. Packer (LPC, DEBU). **Middlesex**, 1♀, Komoka Feed Mill Prairie, 42°58'N, 81°25'W, 11 September 2001, S.M. Paiero. **Lambton**, 1♂, Port Franks, Watson Property nr. L-Lake, 26 August 1996, J. Skevington. **Kent**, 2♂♂ 2♀♀, Rondeau Provincial Park, South Point Trail, 7 September 2002, M. Buck. **Essex**, 6♂♂ 1♀, Point Pelee, 8-9 September 1954, W.R.M. Mason, R. Lambert & G.S. Walley (CNCI); 1♂, Point Pelee, West Beach, 23 August 2000, O. Lonsdale; Leamington, 1♀, 16 August 1982, 1♂, 25 August 1984, 8♂♂, 18 August 1987, T.D. Galloway (EDUM); 1♂, Harrow, 1 September 1971, T.D. Galloway (EDUM); Windsor, Ojibway Prairie, 1♀, 7 August 2001, Y. Cui, 1♂, 13 August 2002, S.A. Marshall, 5♂♂ 19♀♀²⁾ (partly in yellow pans), 26-27 August 2002, M. Buck, 1♀³⁾, 12 September 2002, M. Buck; 3♂♂ 2♀♀, Windsor, Springarden Road ANSI, 27 August 2002, M. Buck & S.M. Paiero.

Distribution. Apparently, there are no previous published records of this species from Ontario. Canada: QC (Finnamore 1982), MB; eastern U.S. west to CO and TX (Bohart and Grissell 1975).

Biology. Nests in large aggregations in sand banks. Prey are various bees of the family Halictidae and *Pseudopanurgus* (Andrenidae) (Krombein 1979).

Prey records. ¹⁾ One female *Lasioglossum* sp. (Halictidae). ²⁾ Four males and two females of *Lasioglossum* spp., one male *Augochlorella striata* (Provancher) (Halictidae). ³⁾ One female *Lasioglossum* sp.

Cerceris astarte Banks, 1913

Ontario: **Hastings**, Marmora, 1♂ 1♀, 25 July 1952, J.R. Vockeroth, 2♂♂, 29 July 1952, E.H.N. Smith (CNCI); Chatterton, 1♂, 29 July 1951, 1♀, 11 August 1951, J.C. Martin (CNCI); 1♂, Stirling, 22 August 1963, A.F. Johnson. **Norfolk**, 3♂♂, Turkey Point Provincial Park, east boundary, 42°42'37"N, 80°19'47"W, 17 August 2003, M. Buck; 2♂♂, Turkey Point Tract at Regional Road 10, 42°42'2"N, 80°20'17"W, 17 August 2003, M. Buck; 1♂, Turkey Point, Front Road 0.8 km E Regional Road 10, 42°41'43"N, 80°20'42"W, 23 August 2003, M. Buck. **Essex**, 1♀, Windsor, Ojibway Prairie, 12 September 2002, M. Buck.

Distribution. Newly recorded for Ontario. Eastern U.S.: NH, NY, MI and WI south to NC and TX (Scullen 1965). Ferguson (1983) recorded the species from "se. Canada", probably referring to the above-mentioned CNCI material examined by him.

Biology. Unknown.

Cerceris compacta Cresson, 1865

Ontario: Kent, 1♂, Chatham, 6 August 1934, H.G. James (CNCI).

Distribution. Newly recorded for Canada. Eastern and southwestern U.S.: NH and SD (incl. NY, PA, OH, MI, WI, MN) south to FL and TX, NM to CA, UT (Scullen 1965); Mexico to Costa Rica (Ferguson 1983).

Biology. Has been reported to use adult *Colaspis brunnea* (F.) (Chrysomelidae) as prey (Krombein 1979).

Cerceris crucis Viereck & Cockerell, 1904

(= *C. rufinoda* auctt., nec Cresson, 1865)

Ontario: Hastings, 2♂♂, Chatterton, 23 and 29 July 1951, J.C. Martin (CNCI). **Essex,** Leamington, 3♀♀, 19 August 1983, 1♂, 7 August 1985, T.D. Galloway (EDUM); 2♀♀, Windsor, Springarden Road ANSI, 27 August 2002, M. Buck & S.M. Paiero.

Distribution. Newly recorded for Ontario. Canada: BC (Krombein 1979, as *C. rufinoda* Cresson), AB; U.S.: NJ, OH, IL, VA, NC, ND to TX, west to OR and CA, AK (Scullen 1965); Mexico: Durango, San Luis Potosí (Krombein 1979). Ferguson (1983) recorded this species from "s. Canada", probably referring to the above-mentioned CNCI material examined by him.

Biology. Weevils of the genera *Miccotrogus* and *Smicronyx* (Curculionidae) are used as prey (Krombein 1979).

Cerceris echo Mickel, 1916

Ontario: Middlesex, 2♂♂, Komoka Feed Mill Prairie, 42°58'N, 81°25'W, 11 July 2001, S.M. Paiero. **Lambton,** 1♀, Port Franks, Karner Blue Sanctuary, 25 July 1996, J. Skevington. **Essex,** 1♂, Windsor prairie, "Spring Garden Road" [= Springarden Road], 3 July 1985, D.M. Wood (CNCI); 5♂♂ 21♀♀, Windsor, Springarden Road ANSI, 31 July 2002, M. Buck.

British Columbia: 1♀, Osoyoos, 1200 ft, 15 July 1953, J.R. McGillis (CNCI).

Distribution. Newly recorded for Ontario and British Columbia. Canada: AB; transcontinental in U.S.: from ME to FL, west to ID and CA; northern Mexico (Scullen 1965; Krombein 1979).

Biology. Nests in sand. Prey are *Olibrus neglectus* Casey and *Phalacrus* (Phalacridae) (Krombein 1979).

Species recognition. The male of this species was never described and is very similar to *C. finitima*. In Ontario, males of *echo* differ consistently from those of *finitima* by the following combination of characters: tegula moderately convex (convexity subequal to greatest diameter of flagellomere III; in *finitima* convexity subequal to 1.5x greatest diameter of flagellomere III), yellow band of tergite 2 anteriorly convex or straight (anteriorly emarginate in *finitima*), and erect setae of sternites 3-6 short (shorter than mid ocellus diameter; in *finitima* longer than mid ocellus diameter). Apparently, in more southern material of both species these diagnostic characters do not always apply.

***Cerceris finitima* Cresson, 1865**

Ontario: Essex, Windsor, Ojibway Prairie, 1♂, 7 August 2001, S.M. Paiero, 2♀♀, 13 September 2002, M. Buck & S.M. Paiero.

Distribution. Newly recorded for eastern Canada. Canada: SK; transcontinental in U.S.: NY to FL, west to WY and CA; northern Mexico (Scullen 1965; Krombein 1979). Finnamore (1982) erroneously recorded this species from Quebec based on a *C. arelate* male that was misidentified by H.A. Scullen (specimen in CNCI, examined). Scullen (1965) did not include this record in his revision of the genus.

Biology. *Chaetocnema pulicaria* Melsheimer (Chrysomelidae) has been recorded as prey (Krombein 1979).

Species recognition. See above under *C. echo*.

***Cerceris fumipennis* Say, 1837**

Ontario: Leeds and Grenville, 1 specimen (digital picture of live specimen), S of Newboro, early September 2002, H. Goulet (picture in collection of H. Goulet). **York,** 1♂ 1♀, Toronto, Lambton Mills, 16 July 1972, "N.J.T." & W.M.M. Edmonds (ROME). **Waterloo,** 1♀, Erbsville, Wideman Road, 17 July 2003, B. Arnal & H. Duggan (BAR). **Halton,** 7♀♀*, Milton, Woodland Trails Camp, 4th Line Nassagaweya, 43°32'51"N, 79°59'35"W, 18 August 2003, M. Buck & S.M. Paiero. **Norfolk,** Manestar Tract, 42°43'N, 80°27'W, 2♂♂, 18-30 July 1992, oak savannah, malaise trap P.J. Carson (LPC, DEBU); 1♂, same except 20-26 August 1993, J.T. Kerr, M. deGiusti & L. Packer (LPC); 4♀♀, Turkey Point Tract at Regional Road 10, 42°42'2"N, 80°20'17"W, 17 August 2003, M. Buck; 3♂♂ 1♀, Normandale Fish Culture Station, 42°43'7"N, 80°20'20"W, 23 August 2003, M. Buck. **Lambton,** 2♂♂, Pinery Provincial Park, powerline, 25-28 June 1986, malaise trap, L. Packer (LPC, DEBU). **Kent,** 1♂, Rondeau Provincial Park, Marsh Trail, nr. parking lot, 42°18'51"N, 81°51'5"W, 16 July 2003, O. Lonsdale. **Essex,** Point Pelee National Park, Old Maintenance Yard, 41°56'54"N, 82°31'14"W, 2♀♀, 30 July 2003, 1♂, 14 August 2003, M. Buck; 1♂, Point Pelee National Park, The Tip parking lot, 41°55'3"N, 82°30'37"W, 13 August 2003, M. Buck; 1♂, Kingsville, 12 August 1954, F.R. Netmore (CNCI); Windsor, Ojibway Prairie, 1♂, 30-31 July 2002, S.M. Paiero, 1♀, 26 August 2002, M. Buck; 1♂, Windsor, Springarden Road ANSI, 31 July 2002, M. Buck.

Distribution. Newly recorded for Ontario. Canada: BC; mostly eastern U.S.: NH to FL (incl. NY, PA, OH, MI, MN), west to WY, CO and NM Scullen (1965). Ferguson (1983) recorded this species from "se. Canada", probably referring to the above-listed CNCI specimen examined by him.

Biology. Nests in hard-packed sand. Prey are adult beetles of various genera of Buprestidae (Krombein 1979).

Prey records. *) Five *Dicerca lurida* (Fabricius), two *D. caudata* LeConte, one *D. divaricata* (Say), three *Descarpentriesina cyanipes* (Say), one *Chrysobothris sexsignata* (Say), two *Actenodes acornis* (Say), one *Agrilus masculinus* Horn, one *A. bilineatus bilineatus* (Weber) (all Buprestidae). Some of the prey items were taken without collecting the *Cerceris* females. Several wasps were observed nesting in a small area of bare, hard-packed soil.

***Cerceris halone* Banks, 1912**

Ontario: Renfrew, 1♀, Calabogie, 13 July 1969, J. Robillard (CNCI). **Peterborough,** 1♀, Millbrook Ganaraska Forest, 10 July 1998, S.A. Marshall. **Northumberland,** 1♀, Murray Hills, 44°7'N, 77°40'W, 1 September 2002, S.M. Paiero. **Norfolk,** 3♀♀, Normandale, 4 September 1954, R. Lambert (CNCI); 2♀♀, S limit of Manestar Tract at Hwy 24, 1 km W Jct. Regional Road 16, 42°41'36"N, 80°27'8"W, 29 August 2001, on *Solidago* flowers, M. Buck; 1♂ 1♀, Turkey

Point Tract at Regional Road 10, 42°42'2"N, 80°20'17"W, 17 August 2003, M. Buck; 5♂♂ 2♀♀, Normandale Fish Culture Station, 42°43'7"N, 80°20'20"W, 23 August 2003, M. Buck. **Essex**, Windsor, Ojibway Prairie, 2♂♂ 3♀♀, 26-27 August 2002, 1♀, 12 September 2002, M. Buck; 1♂, Windsor, Springarden Road ANSI, 27 August 2002, S.M. Paiero.

Distribution. Newly recorded for Ontario. Canada: MB; eastern U.S.: NH to NC, west to ND (Scullen 1965; Ferguson 1983). Ferguson (1983) recorded this species from "se. Canada" probably referring to the above-mentioned CNCI females examined by him.

Biology. Prey are various species of *Curculio* (Curculionidae) (Krombein 1979).

Cerceris insolita Cresson, 1865

Ontario: **Essex**, Windsor, Ojibway Prairie, 1♀, 30-31 July 2002, S.M. Paiero, 1♀, 27 August 2002, M. Buck, 1♀, 12-13 September 2002, yellow pans, M. Buck.

Distribution. Newly recorded for Canada. U.S.: NJ and SD south to FL and AZ; Mexico: Chihuahua, Jalisco (Krombein 1979).

Biology. Nests in flat, coarse-grained sand. Prey are adult *Rhabdopterus praetextus* (Say) (Chrysomelidae) (Krombein 1979).

Cerceris kennicottii Cresson, 1865

Ontario: **Kent**, 1♀, Chatham, 26 July 1954, "host plant red clover", K.G. Davey. **Essex**, 1♀, Leamington, 11 September 1955, D.A. West; 1♀, Point Pelee, 11 September 1961, L.A. Kelton (CNCI); 1♀, NE of Harrow, 3 September 1993, B. Larson; 1♀, Windsor, Ojibway Prairie, 12 September 2002, M. Buck.

Distribution. Newly recorded for Ontario. U.S.: MD to FL and west to SD, CO and CA (Krombein 1979); south to southern Mexico (Ferguson 1983). Scullen (1965) recorded the species from "southern Canada" without naming a province. Ferguson (1983) recorded it from "southeastern Canada" probably based on the above CNCI female, which he had examined.

Biology. Unknown.

Cerceris nitidoides Ferguson, 1983

(= *C. nitida* Banks, 1913; preocc.)

Ontario: **Carleton**, 1♀, Merivale, 25 August 1930, J.J. de Gryse (CNCI).

Distribution. Newly recorded for Ontario. Canada: QC; eastern U.S.: MI, IL, OH, NY, NC, TN, TX (Scullen 1965, as *C. nitida* Banks).

Biology. Unknown.

Cerceris occipitamaculata Packard, 1866

Ontario: **Nipissing** (probably): 1♂, Algonquin [Provincial Park], 2 August 1961, R.J. Pilfrey.

Distribution. Newly recorded for Ontario. Central U.S.: MN and SD to TX and AZ; northern Mexico (Krombein 1979). Ferguson (1983) recorded the species from "southeastern Canada" without naming a province.

Biology. Unknown.

***Cerceris prominens* Banks, 1912**

Ontario: Carleton, 3♂♂ 2♀♀, "W.H.H. Ottawa" [= W.H. Harrington, 1852-1918], without date; 1♀, "29.7", "♀", labelling consistent with Harrington collection (CNCI).

Distribution. Newly recorded for Ontario. Canada: MB; eastern U.S.: ME to AL, west to MI, KS and LA (Scullen 1965).

Biology. Unknown.

Doubtful record***Eucerceris flavocincta* Cresson, 1865**

Ontario: Carleton, 2♂♂, Ottawa, "Division of Entomology, Ottawa, Canada", one specimen with handwritten label "Hanham" [?]. **Locality unknown:** 1♀, no data, labelled with a "♀"-label of the same kind used by Harrington (i.e. possibly from Ottawa region?).

Note. The specimens are very old (from the late 19th or early 20th century) and there remains some doubt whether the label data refers to the collecting locality or the collection where they are housed.

Distribution. A new record for eastern Canada if locality data is correct. Canada: BC to MB; western U.S.: WA to CA, east to MT, SD, WY, CO, NM (Scullen 1968).

Biology. Nests in hard stony soil and preys on weevils of the genera *Dyslobus*, *Panscopus* and *Peritaxia* (Curculionidae) (Krombein 1979).

Notes on the status of some rare species

***Prionyx canadensis* (Provancher, 1887).** – Bohart and Menke (1963) recorded this species from southwestern Ontario. Specimen depositories and collecting localities were not mentioned but map plots point to the London area and Point Pelee. No specimens were found in the collections examined.

***Astata bakeri* Parker, 1962.** – Parker (1962) recorded this species from Prince Edward, Ontario. The depository of the specimen(s) is not mentioned and no material was found during this study.

***Tachysphex pechumani* Krombein, 1938.** – This species has attracted great interest because of its unusual ecology and its restricted, disjunct distribution (Kurczewski 1998a, 2000a, b). At present it is known only from the Lower Peninsula of Michigan, one locality each in northwestern Indiana and northwestern Ohio, the New Jersey Pineland National Reserve and three Ontario counties (Lambton, Norfolk, Simcoe) (Kurczewski 2000b). Five new localities were discovered in 2003 and 2004, representing new county records and the northernmost and easternmost extreme of its range in Ontario:

Grey, 1♂, Hepworth dunes, 44°37'N, 81°9'W, 5 July 2003, white pans, M. Buck. **York,** 1♀, King Township, Joker's Hill, Koffler Scientific Reserve, 44°3'N, 79°29'W, 19 July 2003, sand pit, W. Godsoe. **Wellington,** 1♂ 2♀♀, Guelph, Wellington Street & Fife Rd., 7 August 2004, empty lot, on gravel/sand, M. Buck. **Waterloo,** 2♀♀, Erbsville, 10-11 July 2004, old field, yellow pans, J. Klymko. **Halton,** 1♀, Milton, Woodland Trails Camp, 4th Line Nassagaweya, 43°32'51"N, 79°59'35"W, 23 July 2004, S.M. Paiero.

Species erroneously recorded from Ontario

***Isodontia philadelphica* (Lepeletier, 1845).** – Reported by Harrington (1902) and Walker (1913). Harrington's specimen is *I. mexicana*. Three males and three females from Brodie's collection at the CNCI (without identification label) are also this species and are probably the specimens Walker referred to.

***Podalonia atriceps* (Smith, 1856).** – Reported by Harrington (1902, as *Psammophila communis* (Cresson)) and Walker (1913, as *Sphex communis* (Cresson)). In both cases they were misidentifications of *P. luctuosa* (Smith) and *P. robusta* (Cresson).

***Ammophila conditor* Smith, 1856.** – Reported by Harrington (1902) and Walker (1913, as *Sphex conditor* (Smith)). Misidentification of *A. urnaria* Dahlbom.

***Ammophila pubescens* Curtis, 1836.** – Recorded by Brown (1934) as *Sphex arvensis* (Dahlbom, 1843). This name, which pertains to a Palearctic species, has been consistently misapplied to Nearctic species in the past. Brown's specimens were misidentified *Ammophila azteca* Cameron.

***Diodontus americanus* Packard, 1867.** – Harrington (1902) recorded one female (labelled "J.F. Otta[wa]", label cut off) from the Ottawa area. Misidentification of *D. bidentatus* Rohwer. *Diodontus americanus* is only known from the holotype (Eighme 1989).

***Tachysphex montanus* (Cresson, 1865).** – Harrington (1902, as *T. compactus* Fox, 1894) recorded one female (labelled "4/8") from the Ottawa area. Misidentification of *T. pompiliformis* (Panzer).

***Tachysphex laevifrons* (Patton, 1880).** – Harrington (1902) tentatively referred one female (labelled "12/7") to this species. Misidentification of *T. acutus* (Patton).

***Crabro dietrichi* Bohart, 1976.** – Bohart (1976) recorded this species from Ontario based on misinterpreted locality data from the type series. He quoted the type locality as "Prince Edward Island National Park, Ontario, Canada". The only Prince Edward Island in Ontario is a rather obscure locality (located in Clam Lake near Kearney, Parry Sound Distr.) and not part of any National or Provincial Park. However, two female paratypes in the CNCI (not mentioned by Bohart) are from Prince Edward Island National Park in the Province of P.E.I.. It is likely that *C. dietrichi* will be found in Ontario in future because it is also known from Manitoba and Saskatchewan (Bohart 1976).

***Ectemnius paucimaculatus* (Packard, 1866).** – Harrington (1902, as *Xestocrabro paucimaculatus* Say) recorded one female from the Ottawa area. Misidentification of *E. stirpicola* (Packard).

***Nysson rusticus* Cresson, 1882.** – Provancher (1887) recorded one female of this western species from Ottawa (specimen in ULQC). Misidentification of *N. gagates* Bradley.

***Nysson trichrus* (Mickel, 1916).** – Recorded from Ontario as *Nysson nigripes* Provancher, 1887 (a preoccupied name) by Harrington (1902). This name was later incorrectly synonymized with *N. trichrus* (Mickel) (Bohart and Menke 1976). It is in fact a synonym of *N. gagates* Bradley (Buck, in prep.). All previous Canadian records of *N. trichrus* (e.g., Finnamore 1982) are referable to *N. gagates*.

***Epinysson opulentus* (Gerstaecker).** – This species has frequently been confused with *Epinysson tramosericus* (Viereck) (see note under this species in the section on species newly recorded from Ontario) and many literature records actually refer to the latter. Krombein's (1979) catalogue listing of *E. opulentus* from the Upper Austral zone in Canada is apparently based on misidentified material as no specimens were found in collections. *Epinysson opulentus* seems to be restricted to the southern U.S. (Buck, in prep.).

***Bembix fasciata* Fabricius, 1804.** – This name is a questionable synonym of *B. texana* Cresson, 1872, a species from the southern United States (Krombein 1979). Walker (1913) recorded this species from Toronto. Two males from Brodie's collection at the CNCI (without identification label) are *B. americana spinolae* Lepeletier and are probably the specimens Walker referred to.

***Philanthus pulcher* Dalla Torre, 1897.** – D.B. McCorquodale reported this species from the Port Franks area, Lambton County (Skevington et al. 2001). A series of 18♂♂ and 16♀♀ in the Guelph collection bearing his determination label was re-examined and consists of *Ph. politus* Say and 1♂ of *Ph. lepidus* Cresson.

***Aphilanthops subfrigidus* Dunning, 1898.** – D.B. McCorquodale recorded this species from Port Franks, Lambton County (Skevington et al. 2001). One male (labelled "*A. subfrigidus*?" in D.B.M.'s handwriting) was found in the Guelph collection. It belongs to *A. frigidus* Smith.

Misidentifications and errors in previous papers

The following species of spheciform wasps were misidentified from Ontario in previous papers (besides the ones already mentioned in the previous section):

Harrington (1902), specimens deposited in CNCI:

***Mimumesa propinqua* (Kincaid)** [as *Mimesa borealis* Smith]. – misidentified *Mimesa pauper* Packard (2♀♀).

***Rhopalum pedicellatum* Packard.** – misidentified *Rh. coarctatum* Scopoli (4♂♂ 4♀♀).

***Rhopalum rufigaster* Packard.** – misidentified *Rh. pedicellatum* Packard (1♀).

***Crossocerus minimus* (Packard).** – misidentified *C. lentus* (Fox) (4♂♂ 1♀).

***Ectemnius atriceps* (Cresson)** [as *E. corrugatus* (Packard)]. – misidentified *E. borealis* (Zetterstedt) (3♂♂ 1♀).

***Ectemnius decemmaculatus* (Say)** [as *Pseudocrabro chrysarginus* (Lepeletier)]. – misidentified *E. arcuatus* (Say) (6♂♂).

***Gorytes canaliculatus* Packard** [as *Hoplisis*]. – misidentified *G. atricornis* Packard (4♂♂ 3♀♀).

***Cerceris clypeata* Dahlbom.** – misidentified *C. prominens* Banks (1♀).

Walker (1913). Most of Walker's data is based on William Brodie's regional collection from the Toronto area, one of the most important historical collections of Ontario sphecids. Most of the material is deposited at the ROME but the CNCI has specimens with identical label style and

handwriting (but lacking labels "Wm. Brodie Collection" present on most specimens at the ROME). It appears that Brodie's collection was split taxonomically between the two museums. For instance, all Crabronini are housed at the ROME but the CNCI apparently received all the Nyssonini and Bembicini.

***Mimumesa nigra* (Packard)** [as *Psen*]. – misidentified *Pemphredon inornata* Say (1♂) and *Lyroda subita* (Say) (1♂).

***Passaloecus cuspidatus* Smith** [as *P. mandibularis* (Cresson)]. – misidentified *P. annulatus* (Say) (1♀).

***Trypoxylon clavatum* Say.** – misidentified *T. frigidum* Smith (3♂♂ 1♀).

***Crabro advena* Smith** [as *C. pegasus* (Packard)]. – misidentified *C. argusinus* Bohart (1♂).

***Cerceris clypeata* Dahlbom.** – The only specimen (a male) that was found in the ROME collection is labelled "Penn." [= Pennsylvania]. It is possible that the species was erroneously reported from Toronto.

Brown (1934), specimens deposited in ROME:

***Podalonia violaceipennis* (Lepeletier).** – misidentified *P. robusta* (Cresson) (1♀).

***Ectemnius atriceps* (Cresson)** [as *Solenius corrugatus* (Packard)]. – misidentified *E. borealis* (Zetterstedt) (2♂♂).

***Ceropales bipunctata* Say** [as *Euspongia bipunctata*] (Pompilidae). – misidentified *Alysson conicus* Provancher (1♀).

Blades & Marshall (1994), specimens deposited in DEBU:

***Mimumesa leucopus* (Say).** – misidentified *M. propinqua* (Kincaid) (1♂ 2♀♀).

***Trypoxylon figulus* (L.).** – misidentified *T. attenuatum* Smith (1♀). In Ontario *T. figulus* appears to be restricted to the eastern part of the province. Records from other parts of Ontario (i.e., Sugar et al. 1998) are doubtful.

***Trypoxylon pennsylvanicum* Saussure.** – Among 28 recorded specimens all but one were misidentified *T. attenuatum* Smith.

***Ectemnius ruficornis* (Zetterstedt).** – misidentified *E. arcuatus* (Say) (2♀♀).

Discussion

The present study records 2 species in 2 genera of Ampulicidae, 28 species in 11 genera of Sphecidae, and 248 species in 57 genera of Crabronidae from Ontario. Within the Crabronidae the highest diversity is found in the subfamily Crabroninae (117 species, incl. Larrinae), followed by the Pemphredoninae (55 species), Bembicinae (40 species), Philanthinae (29 species) and Astatinae (7 species). The genera *Podium*, *Ammoplanus*, *Pison*, *Entomognathus*, *Oryttus* and *Stictia* are new records for Canada; the genera *Pseneo*, *Diploplectron*, *Didineis*, *Clitemnestra*, and *Lestiphorus* are recorded for first time from Ontario. One hundred and fourteen species (41.0%) of the total of 278 species are recorded for the first time from Ontario, 53 of which (19.1%) are also newly recorded for Canada, including one new record for the Nearctic Region. Seventy species (25.3%) are not known from any other Canadian province or territory besides Ontario. Eight species (2.9%) are introductions from other biogeographic regions (see the following section).

New species records are also provided for the following Canadian provinces and territories: Labrador (1 species), New Brunswick (4 species), Quebec (8 species), Saskatchewan (5 species), Alberta (5 species), British Columbia (5 species), Yukon Territory (1 species) and Northwest Territories (1 species).

Distribution of Ontario Sphecids

The distribution of Ontario sphecids is shown in Table I. About 9% of the species have a Holarctic distribution (excl. introduced species) and are transcontinental in North America, another 35% are transcontinental but restricted to the New World. Approximately 40% occur only east of the Rocky Mountains in North America; ca. 12% range further westward into the mountain ranges of western North America but without reaching British Columbia or the Pacific states of the U.S.. In the following some interesting distribution patterns are discussed:

Species with mainly western distribution and western disjuncts. Several mainly western species reach the eastern limit of their known range in eastern Canada. Most of these species follow a distribution pattern that covers the western part of the U.S. and a large part of Canada, sometimes including adjacent areas of the northeastern U.S.. In a few species the eastern populations appear to be far removed from the closest known western population, creating the appearance of a broadly disjunct range. Undoubtedly, in many cases these gaps are merely sampling artefacts. However, there appear to be a few examples of species with genuinely disjunct ranges. Different types of distribution patterns in western species are compared below.

Primarily western with scattered populations in east: *Philanthus albopilosus*. This species is widespread in the western U.S (Rocky Mtn. States east to Texas; Krombein 1979). In the eastern Nearctic the species is rare with very localized populations as far east as Michigan (rare on Lower Peninsula; Dreisbach 1945), Ohio (Krombein 1979), New York (Evans 1975b; Kurczewski 1998c) and Ontario (Essex County, Norfolk County, formerly Grey County). In Ontario *Ph. albopilosus* deserves attention for its isolated occurrence and the vulnerability of its populations: the species inhabits areas with broad expanses of bare, fine-grained sand. Former localities in Essex County (Leamington) and Grey County (Hepworth Dunes) have changed drastically since the species was last collected there and no specimens could be found at the latter in 2003.

Apparent disjuncts: *Prionyx canadensis*, *Diploplectron peglowi*, *Tachysphex aethiops*, *T. alpestris*, *T. semirufus*, *Mellinus abdominalis*, *Nysson hesperus*, *Stizoides renicinctus*, *Stictiella emarginata*. Based on previously published distributional data the eastern populations of these species appear to be more or less isolated from the main, western part of their range. The most pronounced apparent 'disjuncts' are *Diploplectron peglowi* and *Nysson hesperus*, which show gaps of more than a thousand of kilometres between the Ontario populations and the closest known western populations (*N. hesperus*: Wyoming; *D. peglowi*: Yukon and Northwest Territories). However, a recent study of their distribution reveals the gaps to be sampling artefacts: *Nysson hesperus* was newly discovered in collections taken in Manitoba and Saskatchewan (Buck, in prep.), linking eastern and western populations, and *Diploplectron peglowi* was found in Saskatchewan about half-way between the known eastern and western Canadian populations. For other species of this group a continuous distribution has not yet been demonstrated but appears very likely.

Genuine disjuncts: *Ammoplanus lenape*, *Solierella levis*, *Trypoxylon bidentatum*, *T. sculleni*. These species appear to have a truly disjunct distribution with widely separated eastern and western populations. In the case of the two *Trypoxylon* species this is probably due to accidental introduction to the eastern Nearctic. Because of their wood-nesting habits species of this genus are prone to be accidentally shipped to new locations. In fact, most of the crabronid species introduced from the Palaearctic region belong to this genus (see below). Both *T. bidentatum* and *T. sculleni* are known from a single specimen only in the eastern Nearctic and have apparently remained very localized or were unable to establish permanent populations. The disjunct range of the other two species appears to be natural. *Ammoplanus lenape* has been divided into an eastern and a western subspecies, both of which are known from two localities only. Further research is necessary to elucidate the

biogeography of this diminutive, cryptic species. Eastern and western populations of *Solierella levis* show only very slight morphological differences, which nonetheless appear to be consistent. The eastern populations of this species were only discovered during this study and the distribution in the eastern Nearctic deserves further investigation.

Northern species. Most spheciform wasps are warmth-loving and there are few genuinely northern species. Unfortunately, the sphecid fauna of the Hudsonian and northern Canadian life zone in Ontario is still practically unstudied because of the inaccessibility of the region. Only four northern species were found in Ontario so far: *Mimumesa clypeata*, *M. atratina*, an undescribed species of *Mimumesa* (sp. A), and *Passaloecus borealis*. The three described species appear to be transcontinental in boreal North America (Finnamore 1997; Buck, in prep.). *Mimumesa clypeata* and *Passaloecus borealis* have also been recorded from mountain ranges of the western U.S. as far south as New Mexico and California. All four species are probably near the southern limit of their range at the newly recorded localities in northern Ontario.

Introduced species. Eight Ontario sphecid species have been accidentally introduced to North America, including five species recorded here for the first time from the province (*Pemphredon morio*, *Passaloecus gracilis*, *Trypoxylon attenuatum*, *T. kolazyi*, *Pison koreense*). An additional three species (*Pemphredon rugifer*, *Rhopalum coarctatum*, *Ectemnius cephalotes*) show an eastern Nearctic/Palaearctic distribution and were probably also introduced to the Nearctic. Six species originated from the western Palaearctic region; only one species, *Pison agile*, was introduced from the eastern Palaearctic or Oriental region (area of origin unknown for the trans-Palaearctic species *Pemphredon morio*, *P. rugifer*, *Trypoxylon figulus*, and *Rhopalum coarctatum*). The oldest introductions are apparently *Pemphredon rugifer*, *Trypoxylon figulus*, *Rhopalum coarctatum* and *Ectemnius cephalotes*, which have been known from North America for well over a century. The most recent introduction appears to be *Pemphredon morio*, which is recorded here for the first time from the Nearctic Region. All introduced species have remained restricted to eastern North America, with *Passaloecus gracilis* and *Rhopalum coarctatum* ranging farthest to the west. Some species occupy a fairly small range like *Trypoxylon figulus*, which apparently has not spread beyond the New England States, Quebec and eastern Ontario (Pulawski (1984); southern Ontario records are probably misidentifications of *T. frigidum*). Furthermore, there are distinct differences of abundance between introduced species: *Trypoxylon kolazyi*, for instance, remains a very rare species and is not known from recent material (see discussion under this species) while other species in the same genus (*T. clavicerum*, *T. attenuatum*) have become well established. At many localities in southern Ontario *Trypoxylon attenuatum* has become the most common species of the genus.

Most of the introduced species of sphechids nest in borings in wood, hollow stems and similar situations. The only exception is *Oxybelus bipunctatus*, which nests in sandy soil. This species is thought to have arrived in North America with ship ballast or molding sand (Kurczewski 1998b).

Zonality of the provincial fauna. Table II gives an overview of the Ontario distribution of the newly recorded species by county/region/district. Many counties/regions are still poorly studied but comparison of the better studied areas show some general trends: As could be expected the highest number of new records was found in counties of southwestern Ontario. This part of the province forms the northernmost expanse of the Carolinian life zone, which harbours many insect species not known from elsewhere in Canada. About 35 of Ontario's species (12.6%) are restricted to the Carolinian part of the province. The highest number of Carolinian species (26) was found in Essex County, which also had the highest total number of new Ontario records (63). The counties with the second and third highest number of new records (Norfolk: 38; Kent: 33) are also located

within the Carolinian life zone. Other counties within this life zone are still poorly studied and their species numbers are not representative. The highest numbers of newly recorded species from counties in the Transition life zone were 30 (Wellington) and 24 (Carleton). Wellington County borders the Carolinian life zone and some species with mainly Carolinian distribution (e.g., *Ammophila pictipennis*, *Trypoxylon politum*) reach the northern limit of their range here. Expectedly, species diversity continues to drop further northward: the best-studied district of the Canadian life zone (Thunder Bay District) reached a total of merely 15 new provincial records. Almost no data is available for sphecids from the Hudsonian life zone in Ontario.

Conclusions and Outlook

It is hoped that this checklist will stimulate further research on the spheciform wasps of Ontario. Vast areas of the province are still very poorly studied, including the Niagara Peninsula, parts of eastern Ontario and most of the Canadian and the Hudsonian life zones. Even for the better-known areas further surprising findings can be expected in future. The results presented in this paper reveal a far higher diversity of spheciform wasps in Ontario than was initially expected. Many of the rarer species are restricted to the southern part of the province and among them some are restricted to habitat types (e.g., oak savannah, relict prairie, dunes) that are scarce and vulnerable. Other species have not been collected in Ontario in recent times (e.g., *Prionyx canadensis*, *Astata bakeri*, *Oxybelus inornatus*, *Synnevrus aurinotus*, *Stizoides renicinctus*, *Oryttus gracilis*, *Cerceris compacta*, *C. nitidoides*, *C. prominens*, *Eucerceris zonata*) and their current status in the province is uncertain. Among these *Stizoides renicinctus* and *Cerceris prominens* have not been collected for a century or more. The habitat requirements and biology of some of the possibly endangered species still remains largely unknown and further research is necessary in order to develop effective conservation plans.

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Literature

- Antropov, A.V. 1994. A review of the *agile* species group of *Pison* (Hymenoptera: Sphecidae: Trypoxylonini). Journal of Hymenoptera Research, 3: 119-132.
- Antropov, A.V. 2003. On the occurrence of *Trypoxylon attenuatum* F. Smith, 1951 (Hymenoptera: Crabronidae: Trypoxylini) in North America. Russian Entomological Journal, 11 [2002]: 437-439.
- Blades, D.C.A and S.A. Marshall. 1994. Terrestrial arthropods of Canadian peatlands: Synopsis of pan trap collections at four southern Ontario peatlands. Memoirs of the Entomological Society of Canada, 169: 221-284.
- Bohart, R.M. 1974. A review of the genus *Rhopalum* in America north of Mexico (Hymenoptera: Sphecidae). Journal of the Georgia Entomological Society, 9: 252-260.
- Bohart, R.M. 1976. A review of the Nearctic species of *Crabro* (Hymenoptera: Sphecidae). Transactions of the American Entomological Society, 102: 229-287.
- Bohart, R.M. 1994. A key to the genus *Tachytes* in America north of Mexico with descriptions of three new species (Hymenoptera, Sphecidae, Larrinae). Proceedings of the Entomological Society of Washington, 96: 342-349.
- Bohart, R.M. 1996. A review of the genus *Bicyrtes* (Hymenoptera: Sphecidae, Nyssoninae, Bembicini). Insecta Mundi, 10: 139-152.
- Bohart, R.M. 1997. A review of the genus *Hoplisoides* Gribodo (Hymenoptera: Sphecidae: Gorytini) in North America. Proceedings of the Entomological Society of Washington, 99: 645-660.
- Bohart, R.M. and J.E. Gillasp. 1985. California sand wasp of the subtribe Stictiellina. Bulletin of the California Insect Survey, 27: vi + 89 pp.
- Bohart, R.M. and E.E. Grissell. 1975. California wasps of the subfamily Philanthinae (Hymenoptera: Sphecidae). Bulletin of the California Insect Survey, 19: 1-92.
- Bohart, R.M. and A.S. Menke. 1963. A reclassification of the Sphecinae with a revision of the Nearctic species of the tribes Sceliphronini and Sphecini (Hymenoptera, Sphecidae). University of California Publications in Entomology, 30: 91-181.
- Bohart, R.M. and A.S. Menke. 1976. Sphecid Wasps of the World. University of California Press, Berkeley, Los Angeles, London. ix + 695 pp.
- Bohart, R.M. and N.J. Smith. 1994. Contributions to the knowledge of the genus *Spilomena* Shuckard in America north of Mexico (Hymenoptera, Sphecidae, Pemphredoninae). Journal of the Kansas Entomological Society, 67: 318-330.
- Brown, A.W.A. 1934. A contribution to the insect fauna of Timagami. The Canadian Entomologist, 66: 206-211, 220-231, 242-252, 261-267.
- Coville, R.E. 1982. Wasps of the Genus *Trypoxylon* Subgenus *Trypargilum* in North America (Hymenoptera, Sphecidae). University of California Publications in Entomology, 97: vi + 147 pp.
- Coville, R.E. 1984. The occurrence of *Trypoxylon clavicerum* in North America (Hymenoptera, Sphecidae). Pan-Pacific Entomologist, 60: 256-257.
- Dollfuss, H. 1995. A worldwide revision of *Pemphredon* Latreille 1796 (Hymenoptera, Sphecidae). Linzer Biologische Beiträge, 27: 905-1019.
- Dreisbach, R.R. 1945. The genera *Aphilanthops*, *Oclocletes*, and *Philanthus* (Hymenoptera, Philanthidae) in Michigan, with keys and distribution. Papers of the Michigan Academy of Science, Art and Letters, 31: 141-145.
- Eighme, L.E. 1989. Revision of *Diodontus* (Hymenoptera: Sphecidae) in America north of Mexico. Annals of the Entomological Society of America, 82: 14-28.

- Evans, H.E. 1975a. Digger wasps as colonizers of new habitat (Hymenoptera: Aculeata). *Journal of the New York Entomological Society*, 82 [1974]: 259-267.
- Evans, H.E. 1975b. Nesting behaviour of *Philanthus albopilosus* with comparisons between two widely separated populations. *Annals of the Entomological Society of America*, 68: 888-892.
- Evans, H.E. and R.W. Matthews. 1968. North American *Bembix*, a revised key and suggested grouping. *Annals of the Entomological Society of America*, 61: 1284-1299.
- Ferguson, G.R. 1983. An annotated synonymic list of North American and Caribbean wasps of the genus *Cerceris* (Hymenoptera: Philanthidae). *Journal of the New York Entomological Society*, 91: 466-502.
- Ferton, C. 1912. Notes détachées sur l'instinct des Hyménoptères mellifères et ravisseurs (7^e série) avec la description de quatre espèces nouvelles. *Annales de la Société Entomologique de France*, 80 [1911]: 351-412.
- Finnamore, A.T. 1982. The Sphecoidea of Southern Quebec (Hymenoptera). *Lyman Entomological Museum and Research Laboratory, Memoir*, 11: ix + 348 pp.
- Finnamore, A.T. 1983. Revision of the American Species of *Mimesa* (Hymenoptera: Pemphredoninae: Pseninae). *Lyman Entomological Museum and Research Laboratory, Memoir*, 12: vii + 171 pp.
- Finnamore, A.T. 1994. Hymenoptera of the Wagner Natural Area, a boreal spring fen in Central Alberta. *Memoirs of the Entomological Society of Canada*, 169: 181-220.
- Finnamore, A.T. 1997. Aculeate wasps (Hymenoptera: Aculeata) of the Yukon, other than Formicidae. In Danks, H.V. and J.A. Downes: *Insects of the Yukon. Biological Survey of Canada Monograph Series*, 2: 867-900.
- Finnamore, A.T. and C.D. Michener. 1993. Chapter 9. Superfamily Apoidea. pp. 279-357 In H. Goulet and J.T. Huber (eds): *Hymenoptera of the World: An Identification Guide to Families. Research Branch, Agriculture Canada, Publication 1894/E*, Ottawa. 668 pp.
- Fye, R.E. 1965. The biology of the Vespidae, Pompilidae, and Sphecidae (Hymenoptera) from trap nests in northwestern Ontario. *The Canadian Entomologist*, 97: 716-744.
- Harrington, W.H. 1902. Fauna Ottawaensis. Hymenoptera – Superfamily II. – Sphegoidea. *The Ottawa Naturalist*, 15: 215-224.
- Johnson, J.B. 1985. *Mellinus abdominalis* Cresson (Hymenoptera: Sphecoidea: Mellinidae) discovered in Idaho and Alberta. *Pan-Pacific Entomologist*, 61: 236.
- Krombein, K.V. 1979. Sphecoidea. pp. 1573-1740 In Krombein, K.V., P.D. Hurd, D.R. Smith and B.D. Burks (eds): *Catalog of Hymenoptera in America North of Mexico. Vol. 2: Apocrita (Aculeata)*. Smithsonian Institution Press, Washington.
- Krombein, K.V. and S. Shanks Gingras. 1984. Revision of North American *Liris* Fabricius (Hymenoptera: Sphecoidea: Larridae). *Smithsonian Contributions to Zoology*, 404: iii + 96 pp.
- Kurczewski, F.E. 1998a. Distribution, status, evaluation, and recommendations for the protection of *Tachysphex pechumani* Krombein, the antennal-waiving wasp. *Natural Areas Journal*, 18: 242-254.
- Kurczewski, F.E. 1998b. Dispersal and range expansion of an introduced sand wasp, *Oxybelus bipunctatus* (Hymenoptera: Sphecidae), in eastern North America. *Entomological News*, 109: 1-6.
- Kurczewski, F.E. 1998c. Comparison of sand nesting wasp (Hymenoptera) from two pine barrens in upstate New York. *Entomological News*, 109: 247-251.
- Kurczewski, F.E. 2000a. History of White Pine (*Pinus strobus*)/oak (*Quercus* spp.) savanna in southern Ontario, with particular reference to the biogeography and status of the Antenna-waving Wasp, *Tachysphex pechumani* (Hymenoptera: Sphecidae). *The Canadian Field Naturalist*, 114: 1-20.

- Kurczewski, F.E. 2000b. First record of *Tachysphex pechumani* (Hymenoptera: Sphecidae) from Indiana. *The Great Lakes Entomologist*, 33: 41-43.
- Kurczewski, F.E. and E.J. Kurczewski. 1971. Host records for some species of *Tachytes* and other Larrinae. *Journal of the Kansas Entomological Society*, 44: 131-136.
- Kurczewski, F.E. and R.C. Miller. 1991. Range extensions for species of Sphecidae (Hymenoptera) in the northeastern United States. *The Great Lakes Entomologist*, 24: 253-254.
- Leclercq, J. 2000. Hyménoptères Spécifiques Crabroniens des Amériques du genre *Crossocerus* Lepeletier & Brullé, 1835. *Notes Fauniques de Gembloux*, 40: 3-75.
- Lith, J.P. van. 1975. Neotropical species of *Psen* and *Pseneo* (Hymenoptera, Sphecidae, Psenini). *Tijdschrift voor Entomologie*, 118: 1-41.
- Lomholdt, O. 1975-76. The Sphecidae (Hymenoptera) of Fennoscandia and Denmark. *Fauna Entomologica Scandinavica*, 4(1): 1-224 (1975), (2): 225-452 (1976). Scandinavian Science Press, Klampenborg.
- Malloch, J.R. 1933. Review of the wasps of the subfamily Pseninae of North America (Hymenoptera: Aculeata). *Proceedings of the United States National Museum*, 82: 1-60.
- Marshall, S.A., S.M. Paiero and C.S. Onodera. 2001. Biodiversity assessment: arthropods. Bruce Peninsula National Park and Fathom Five National Park. Project #20002400. Final report to Parks Canada, 329 pp.
- Melo, G.A.R. 1999. Phylogenetic relationships and classification of the major lineages of Apoidea (Hymenoptera), with emphasis on the crabronid wasps. *Scientific Papers, Natural History Museum of the University of Kansas*, 14: 1-55.
- Menke, A.S. 1964. New species of North American *Ammophila* (Hymenoptera, Sphecidae). *Acta Hymenopterologica*, 2 (1963): 5-27.
- Menke, A.S. 1965. A Revision of the North American *Ammophila* (Hymenoptera, Sphecidae). Ph.D. dissertation, University of California, Davis, iii + 247 pp.
- Menke, A.S. 1988. *Pison* in the New World: a revision (Hymenoptera: Sphecidae: Trypoxylini). *Contributions of the American Entomological Institute*, 24(3): i-iii, 171 pp.
- Miller, R.C. 1976. A review of the *hilaris* species group of *Crabro* (Hymenoptera: Sphecidae). *The Florida Entomologist*, 59: 241-265.
- Murray, W.D. 1940. *Podalonia* (Hymenoptera: Sphecidae) of North and Central America. *Entomologica Americana*, 20: 1-77.
- Natural Resources Canada. 2004. Geographical Names of Canada. <http://geonames.nrcan.gc.ca>.
- O'Brien, M.F. 1984. *Diploplectron peglowi*, a new record for Michigan (Hymenoptera: Sphecidae: Astatinae). *The Great Lakes Entomologist*, 17: 119-120.
- O'Brien, M.F. 1987. Biology and distribution of *Tachysphex aethiops* in Michigan (Hymenoptera: Sphecidae: Larrinae). *The Great Lakes Entomologist*, 20: 71-74.
- O'Brien, M.F. 1989a. New state records of bembecine sand wasps in Michigan (Hymenoptera: Sphecidae: Bembecinae). *The Great Lakes Entomologist*, 22: 103-104.
- O'Brien, M.F. 1989b. Distribution and biology of the Sphecinae wasps of Michigan (Hymenoptera: Sphecidae: Sphecinae). *The Great Lakes Entomologist*, 22: 199-217.
- Ohl, M. 1999. A revision of *Stizoides* Guérin-Méneville, 1844: Taxonomy, phylogenetic relationships, biogeography, and evolution (Hymenoptera: Apoidea, "Sphecidae"). *Mitteilungen aus dem Museum für Naturkunde in Berlin, Zoologische Reihe*, 75: 63-169.
- Ontario Road Atlas, 2004 Edition (published 2003). MapArt Publishing, Oshawa, Ontario, 130 pp.
- Parker, F.D., 1962. On the subfamily Astatinae, with a systematic study of the genus *Astata* of America north of Mexico (Hymenoptera: Sphecidae). *Annals of the Entomological Society of America*, 55: 643-659.
- Pate, V.S.L. 1944. The subgenera of *Crossocerus* with a review of the Nearctic species of the subgenus *Blepharipus* (Hymenoptera: Sphecidae: Pemphilidini). *Lloydia*, 6 (1943): 267-317.

- Provancher, L., 1883. Petite faune entomologique du Canada et particulièrement de la province de Quebec. Quatrième ordre. Les Hyménoptères. Quebec, pp. 153-830.
- Provancher, L., 1885-1889. Additions et corrections au volume II de la faune entomologique du Canada traitant des Hyménoptères. Quebec, 475 pp.
- Pulawski, W.J. 1984. The status of *Trypoxylon figulus* (Linnaeus, 1758), *medium* de Beaumont, 1945, and *minus* de Beaumont, 1945 (Hymenoptera: Sphecidae). Proceedings of the California Academy of Sciences, 43: 123-140.
- Pulawski, W.J. 1988. Revision of North American *Tachysphex* Wasps Including Central American and Caribbean Species (Hymenoptera: Sphecidae). Memoirs of the California Academy of Sciences, 10: vi + 211 pp.
- Pulawski, W.J. 2004. Catalog of Sphecidae sensu lato (= Apoidea excluding Apidae). [http://www.calacademy.org/research/entomology/Entomology/Resources/Hymenoptera/sphecidae/Genera and "species" PDF/introduction.htm](http://www.calacademy.org/research/entomology/Entomology/Resources/Hymenoptera/sphecidae/Genera%20and%20species%20PDF/introduction.htm).
- Romel, K.E. and M.D. Dykstra. 1991a. Insect and related pests of lawns, forage grasses & legumes. The Canadian Agricultural Insect Pest Review, 69: 11-12.
- Romel, K.E. and M.D. Dykstra. 1991b. Insect and related pests of households. The Canadian Agricultural Insect Pest Review, 69: 38-40.
- Sandhouse, G.A. 1940. A review of the Nearctic wasps of the genus *Trypoxylon* (Hymenoptera: Sphecidae). The American Midland Naturalist, 24: 133-175.
- Scudder, G.G.E. 1979. Present Patterns in the Fauna and Flora of Canada. In Danks, H.V. Canada and its Insect Fauna. Memoirs of the Entomological Society of Ontario, 108: 87-179.
- Scullen, H.A. 1965. Review of the Genus *Cerceris* in America North of Mexico (Hymenoptera: Sphecidae). Proceedings of the United States National Museum, 116: 333-548.
- Scullen, H.A. 1968. A revision of the genus *Eucerceris* Cresson (Hymenoptera: Sphecidae). United States National Museum Bulletin, 268: v + 97 pp.
- Skevington, J., D. Caloren, K. Stead, K. Zufelt and J. Connop. 2001. Insects of North Lambton. Lambton Wildlife Incorporated, Sarnia, Ont.; vi + 181 pp.
- Steiner, A.L. 1973. Solitary wasps from subarctic North America – II. Sphecidae from the Yukon and Northwest Territories, Canada: distribution and ecology. Quaestiones Entomologicae, 9: 13-34.
- Strickland, E.H. 1947. An annotated list of the wasps of Alberta. The Canadian Entomologist, 79: 121-130.
- Sugar, A., A. Finnamore, H. Goulet, J. Cumming, J.T. Kerr, M. de Giusti and L. Packer. 1998. A preliminary survey of symphytan and aculeate Hymenoptera from oak savannahs in southern Ontario. Proceedings of the Entomological Society of Ontario, 129: 9-18.
- Vincent, D.L. 1978. A revision of the genus *Passaloecus* (Hymenoptera: Sphecidae) in America north of Mexico. The Wasmann Journal of Biology, 36: 127-198.
- Walker, E.M. 1913. Insects and Their Allies. pp. 295-403 In J.H. Faull (ed.): The Natural History of the Toronto Region Ontario, Canada. Canadian Institute, Toronto. 419 pp.

ONTARIO NEST-BUILDING BEES OF THE TRIBE ANTHIDIINI (HYMENOPTERA, MEGACHILIDAE)

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Abstract

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Five species of nest-building Anthidiini are reported from Ontario, including three species of *Anthidium* Fabricius, and one species each of *Dianthidium* Cockerell and *Anthidiellum* Cockerell. A key to identification of males and females is presented, along with descriptions, notes about their biology, and locality records. *Anthidiellum oblongatum* (Latreille), *A. psoraleae* (Robertson) and *Anthidiellum notatum* (Cockerell) are recorded from Ontario for the first time.

Introduction

The tribe Anthidiini is represented in Ontario by three genera of nest-building bees – *Anthidium* Fabricius, *Dianthidium* Cockerell, and *Anthidiellum* Cockerell, - and one genus of cleptoparasitic bees – *Stelis* Panzer, which will be treated in another report. Little is known about nest-building Anthidiini in Ontario. Examination of specimens in several Ontario insect collections revealed the presence of five species of nest-building Anthidiini in Ontario. Of these, *Anthidium manicatum* (L.), which was recorded for the first time for Ontario from Freelon and Guelph (Smith 1991), is widespread in southern Ontario. The few specimens of *A. oblongatum* (Illiger) and *Anthidiellum notatum* (Latreille) have been collected in Ontario only recently (1999, 2002) in the regions where special collecting has been provided regularly; the widely distributed *A. psoraleae* (Robertson) and *Dianthidium simile* (Cresson) are represented in the collections only from the separate areas. As a consequence, it is evident that further collection is necessary to determine the distribution of the described species, particularly on their northern periphery. The purpose of this report is to make possible the accurate recognition of these species, and bring up to date the information concerning their presence in Ontario.

Materials and Methods

A total of 120 specimens of nest-building Anthidiini were examined from the Entomology collections at the Royal Ontario Museum (ROME), University of Guelph (DEBU), and Canadian National Collection of Insects (CNCI). Morphological characteristics, flight period and distributional data on the species are based on specimens from these collections. Morphological terms used in this paper are defined and illustrated in Michener (2000). Identifications were made or confirmed using Mitchell (1960, 1962) and Michener (2000). Overall geographical distributions of the species in North America are based on Hurd (1979) and Hoebeke and Wheeler (1999).

Family Megachilidae

The Megachilidae is represented in Ontario by over 60 species, all of which belong to the subfamily Megachilinae, and are distributed among four genera of Anthidiini, four of Osmiini, and two of Megachilini (MacKay and Knerer 1979; Ivanochko 1979). Females of nest building species of Megachilidae are recognized by the scopa located on the ventral part of metasoma. Nests are made from mineral or plant material collected by the adult female outside the nest.

Tribe Anthidiini

Anthidiini are easily distinguished from other megachilid bees of the local fauna by the black integument with conspicuous yellow maculation on body parts other than legs. The stigma is short, its inner margin not much longer than its width.

Key to the nest-building Anthidiini of Ontario

1. Aroliae present. Female mandible with at most 4 teeth. Nest cells made from resin. 2
- Aroliae absent. Female with mandible with at least 5 teeth. Nest cells made from plant hairs.
***Anthidium* Fabricius** 3
2. Scutellum with hind margin produced to form a carinate and broadly truncate lip over-hanging posterior surface of propodeum. Anterior margin of pronotal lobes not extending along anterior border of scutum, not expended, not carinate. Hind coxae without tooth ***Anthidiellum notatum* (Latreille)**
- Scutellum with hind margin round, not overhanging propodeum. Anterior margin of pronotal lobes broadly expended, conspicuously carinate, extending along anterior border of scutum. Hind coxae with long tooth, directed posteriorly. ***Dianthidium simile* (Cresson)**
3. Scutum carinate laterally, produced posteriorly, forming a tooth. Male tergum 7 bilobed, without median tooth. Body length 8-9 mm. ***A. oblongatum* (Latreille)**
- Scutum not carinate laterally, without teeth. Male tergum 7 with median tooth. 4
4. Female clypeus with fore edge straight, with 3 small lateral teeth, separated from the remaining part of clypeus by a groove; face, mandibles, and scutum black, without yellow marks; legs mostly black; mandible with second tooth longer than the third one. Male tergum 7 bilobed, with median apical tooth. Body length 8-11 mm. ***A. psoraleae* (Robertson)**
- Female clypeus with fore edge arcuate, tuberculate, not separated from rest of clypeus; face, mandibles, and scutum with yellow marks; legs mostly yellow; mandible with second tooth shorter than the third one. Male tergum 7 with long, curved downwards lateral teeth, and shorter, slender mid tooth. Body length 11-17 mm. ***A. manicatum* (L.)**

Annotated list of the Anthidiini bees in Ontario collections

1. ***Anthidium manicatum* (L.)**

Female mandible with tooth 2 shorter than 3, teeth 3 and 4 close to one another. Yellow coloration is on mandibles, paraocular area, marks on vertex, antero-lateral margins of scutum, pronotal lobes, tegulae, axillae, scutellum, and legs. Terga 1-6 with wide interrupted bands not

enlarged laterally; terga with deep and dense puncture of irregular size on basal part. Scutellum with apical emargination. Body length 11-13 mm.

Male tergum 6 with long, curved, lateral tooth. Clypeus yellow with black base. Tibiae and basitarsi yellow. Terga 1-6 with yellow bands, on sides with long, erect, orange hair brush. Body length 14-17 mm.

Flight period in Ontario: June - September. Palearctic. US (New York, Pennsylvania), South America, Canary Islands.

Material. **Cochrane Co.:** Hungry Hollow, 17.VIII.1994, ♀, Rider (DEBU). **Northumberland Co.:** Murray Hills, 1.IX.2002, ♂, S. Paiero (DEBU); Hamilton, 29.IX.94, 3♂, Patterson; 3-22.VIII.1992, 3♀, 2♂, *Stachys officinalis*, *Salvia farinacea* Skevington (DEBU). **York Co.:** Toronto, Humber River, 12.VI-4.IX. 1999, 22♀; 1.VI-18.VIII.1999, 19♂, *Vicia* sp., T. Romankova; 28.VII.1992, 2♂, *Monardia* sp. (ROME). **Willington Co.:** Rockwood, 1.VIII.1992, ♂, *Stachys byzantina*, I. Smith (DEBU). **Halton Co.:** Burlington, Kerns Road, 12.VII.1997, ♂, Crins (DEBU). **Wellington Co.:** Guelph, 15-23.VII.1994, 2♀, 2♂, Coote (ROME); 6.VI.1998, ♀, J. Daley; 17.IX.1995, ♀, Lauro; 20.VII.1994, ♂, J. Dow; 7.VIII.1994, ♂, Rios; 17.VIII.1993, ♂, Caloren; 20.IX.1993, ♂, Bickey; 5.VIII.1992, ♂, *Stachys byzantina*, I. Smith; 14.VI.1991, ♀, 2♂, I. Smith; 7.VIII.1991, ♂; 5.VII.1990, 3♂, *Stachys olimpica*, I. Smith (DEBU). **Wentworth Co.:** Freelon, 25.VII.1992, ♀, ♂, I. Smith; 23.VI.1984, ♂, Kassera (DEBU). **Brant Co.:** Brantford, 24.VIII.2002, ♀, ♂, S. Paiero (DEBU). **Middlesex Co.:** Komoka, 11.VII.2001, ♂, S. Paiero (DEBU). **Essex Co.:** Windsor, Ojibway Prairie, 12-13.IX.2002, ♀, ♂, M. Buck (DEBU).

2. *A. oblongatum* (Latreille)

Female. Pronotal lobe with carina elevated to form a lamella. Tergum 6 concave in profile. Clypeus with slightly incurved anterior margin, yellow, with a pair of black spots on the base. Mandibles multidentate, with big first, three mid-size, and six small teeth. Terga 1-6 with yellow bands slightly interrupted medially; terga on basal half, within yellow marks, with large confluent pits wider separated on mid black part of disc; posterior half of terga with smaller pits with linear interspaces; impunctate margin of terga narrower than base of antennal flagellum.

Male. Tergum 7 bilobed, without mid tooth. Tergum 6 with long lateral and small central apical teeth. Clypeus completely yellow. Terga 1-7 with yellow bands. Body length 8-9 mm.

Flight period in Ontario: August. Palearctic. U.S.: Maryland, New Jersey, New York, Pennsylvania.

Material. **Essex Co.:** Windsor, Ojibway Prairie, 26.VIII.2002, ♀, M. Buck; Windsor, Springarden Road, 27.VIII.2002, ♀, ♂, M. Buck (DEBU).

3. *A. psoraleae* (Robertson)

Female. Mandibles with tooth 2 longer than 3; tooth 3 and 4 separated with wide emargination. Clypeus completely punctured, diameter of pits greater than interspaces. Yellow marks on temples, tegulae, and knees. Terga 1-5 with narrow yellow bands, enlarged on sides, narrowly interrupted medially; terga 1-5 basal part shiny, finely punctured with pits much smaller than distances between them. Scutellum posteriorly around, not emarginated. Middle tibiae with anterior apical tooth.

Male. Clypeus yellow with two small black basal marks; yellow space between clypeus and eye extended to antennae. Mandibles and basitarsi yellow. Yellow body marks variable in size and shape, usually present on tegulae, knees, and terga 1-5. Tergum 6 black, with strong lateral tooth. Body length 8-11 mm.

Flight period in Ontario: June - July. U.S.: North Dakota, Colorado, Illinois, Michigan, Maryland.

Material. Rainy River District: Atikokan, 22.5 km E HWY11, 3.VII.1978, ♂, H. Teskey (CNCI). **Thunder Bay District:** 24.VI.1984, ♀, Prideau, R. Jaagumagi (ROME); Silver Islet, Sibley Peninsula, 18.VII.1861, ♂, H. Milliron (CNCI). **Kenora District:** 8-16 km N Kenora, 13.VII.1961, ♀, H. Milliron (CNCI).

4. *Dianthidium simile* (Cresson)

Female. Mandibles 3-toothed, black; clypeus with straight margin, a pair of yellow marks, and punctures greater than interspaces. Yellow coloration is on paraocular area, temple patches, pronotal lobes, tegulae, axillae, on fore margin of scutum, tibiae outer surface, tibial spurs, terga 1-5 bands.

Male. Yellow coloration on paraocular area, mandibles, clypeus, patches on temples, tubercles, axillae, anterior margin of scutum, scutellum, terga 1-5 bands, tergum 7, tips of femur, and outer surface of tibiae. Tergum 7 bilobed, with longitudinal middle ridge. Body length 9-10 mm. Nests in wood, cells made from resin.

Flight period in Ontario: July - August. From Manitoba to Atlantic, south to Georgia.

Material. Sudbury District: Sudbury, 18.VIII.1889, ♀, ♂; 21.VII.1889, ♂ (CNCI). **Haliburton Co. & Muskoka District:** Dorset, 1.IX.1976, 2♀, D. Pengelly (DEBU). Parry Sound: Trout Creek, 3.VIII.1978, ♂, I. Smith (DEBU). **Nipissing District:** Algonquin Park, 19.VIII.2002, ♀, ♂, M. Buck (DEBU). **Carleton Co.:** Shirley's Bay, 22.VII.1985, ♀, ♂, Sunborne; 5-19.VIII.1985, 2♂, Sunborne (CNCI); Ottawa, 3.VIII.1955, ♂, Tasehareau; 7.VII.1913, ♀, F. Sladen (CNCI). **Lanark Co.:** N. Burgess Twp., 24.VIII.1972, ♀, Wood (CNCI). **Victoria Co.:** Carden, 23.VII.1979, ♀, Catling (ROME). **Northumberland Co.:** Brighton, 17-20.VII.1956, 2♂ (CNCI). **Durham Co.:** Port Hope, 28-VII.1913, ♀, F. Sladen (CNCI). **Bruce Co.:** Dyers Bay, 12.VIII.1952, ♂, D. Pengelly (DEBU). **Wellington Co.:** Guelph, IX.1913, ♂, Bunrons (CNCI). **Norfolk Co.:** Manester Tract, 6 km NNW St. Williams, 25.VII.2000, 5♀, M. Buck (DEBU).

5. *Anthidiellum notatum* (Latreille)

Female. Yellow coloration on wide space on clypeus, paraocular area, stripe along preoccipital ridge, pronotal lobes, tibiae and tarsi, axillae, antero-lateral margin of scutum; tergum 1 lateral patches, tergum 2 narrowly interrupted band, terga 3-5 paramedial pair patches yellow. **Male.** Tergum 7 with apical margin sinuate. Yellow coloration similar to female, with additional marks on mandibles, clypeus, supraclypeal area, terga 3-5 lateral marks, terga 6 and 7 apical bands. Wings dark. Body length 7 - 8 mm. Nests consisting of resin, cells are constructed in the open.

Flight period in Ontario: July - August. From Pacific to Atlantic, from British Columbia to California and Florida.

Material. Halton Co.: Hilton Falls, 16.VII.1999, ♀, T. Romankova; Bruce Trail near Speyside, 12.VIII.1999, ♀, ♂, T. Romankova (ROME). **Peel Co.:** Terra Cotta, 17.VII.1999, ♂, T. Romankova (ROME). **Brant Co.:** Brantford, 12.VII.2002, ♂, S. Paiero (DEBU).

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References

- Hoebeker, R., A.G. Wheeler, Jr. 1999. *Anthidium oblongatum* (Illiger): an Old World bee (Hymenoptera: Megachilidae) new to the North America, and new North American records for another adventive species, *A. manicatum* (L.). University of Kansas Natural History Museum Special Publication No. 24: 21-24.
- Hurd, P.D. 1979. Superfamily Apoidea, pp. 1741-2209 in K.V. Krombein, P.D. Hurd, Jr., D. R. Smith, and B. D. Burks, eds., Catalog of Hymenoptera in America North of Mexico. Vol.2. Washington, Smithsonian Institution Press. 2209 pp.
- Ivanochko, M. 1979. Taxonomy, biology, and alfalfa pollinating potential of Canadian leaf-cutter bees – genus *Megachile* Latreille (Hymenoptera, Megachilidae). Thesis (M.Sc.) Montreal: McGill University. 378 pp.
- MacKay, P. A., and G. Knerer. 1979. Seasonal occurrence and abundance in a community of wild bees from an old field habitat in Southern Ontario. Canadian Entomologist, 3: 367-376.
- Michener, C. D. 2000. The Bees of the World. Baltimore & London: Johns Hopkins University Press. 913pp.
- Mitchell, T. B. 1960. Bees of the eastern United States, 1. North Carolina Agricultural Experiment Station Technical Bulletin no. 141. 538 pp.
- Mitchell, T. B. 1962. Bees of the eastern United States, 2. North Carolina Agricultural Experiment Station Technical Bulletin no. 152. 557 pp.
- Smith, I. 1991. *Anthidium manicatum* (Hymenoptera: Megachilidae), an interesting new Canadian record. Proceedings of the Entomological Society of Ontario, 122: 105-108.

**BEEES OF GENUS *COLLETES* OF ONTARIO
(HYMENOPTERA, APOIDEA, COLLETIDAE)**

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Abstract

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Sixteen species of *Colletes* are reported from Ontario, seven of these, *C. aberrans*, *C. aestivalis*, *C. hyalinus*, *C. latitarsis*, *C. thoracicus*, *C. validus*, and *C. wilmattae*, are new records for the province. The *Colletes* flight period in Ontario begins in early April. The peak of diversity is in July-August. Identification keys for males and for females are given to identify Ontario species.

Introduction

There has been no systematic study of *Colletes* in Ontario. A few records are scattered in the literature (e.g., MacKay and Knerer 1979). Thus, the opportunity to study this group of bees from the largest bee collections of eastern Canada was most welcome. I present the first annotated list of Ontario *Colletes*. Species identification keys by males and females are given.

Material Examined

All material is deposited in the entomological collections of the Royal Ontario Museum (ROME), University of Guelph (DEBU), and Canadian National Collection of Insects (CNCI). Morphological characteristics, flight period and distribution data on the species are based on specimens from these collections. Distribution records from outside Ontario are given according to literature records (Hurd 1979). Morphological terms used in this paper are defined and illustrated in Michener (2000).

More than 1200 specimens were identified using Mitchell (1960 and 1962) and Stephen (1954). All existing determinations in the collections studied were checked.

Family Colletidae

Holarctic Colletidae are recognized by their short, truncate, bilobed glossa, and subantennal suture meeting the antennal socket at its inner side. Nest cells are lined with cellophane-like material.

The family Colletidae is represented in Ontario by both holarctic genera – *Colletes* Latreille and *Hylaeus* Fabricius. They are a common element of the local bee fauna.

Genus *Colletes* Latreille

Species of *Colletes* are medium to large in size (7 – 14 mm), with females generally being larger than males of the same species. Integument black, weakly to moderate sculptured. Pubescence abundant on head, thorax, and legs, mostly white and tawny in colour, sometimes with dark hairs on tergal discs, or admixed on head or dorsal surface of body. Metasoma of both males and females almost conical, with white hair bands, in female without pygidial and prepygidial fimbriae. Fore

wing with three submarginal cells and outwardly arcuate posterior part of the second recurrent vein. The last feature alone is sufficient to separate bees of this genus from any other.

Colletes nest in the ground, the cell lining and closure are of a cellophane-like material, the food provision is liquid, and the egg is attached to the upper wall of the cell (Michener 2000).

Data on hand indicates that there are 16 species of *Colletes* in Ontario, 7 of which are newly recorded for the province. At least 3 species that occur in adjacent areas are expected for Ontario: *C. banksi* Swenk, *C. brevicornis* Robertson, and *C. mandibularis* Smith.

Flight activity of *Colletes* species begins in early April (Figure1). Through July – August *Colletes* abundance and diversity are at a peak; 14 species nest at that time. Half of these species disappear only with colder September weather.

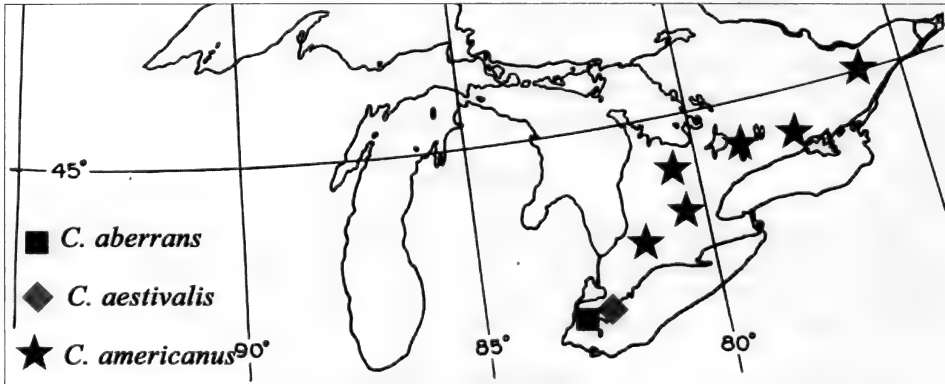


FIGURE 1. Ontario collection localities of *Colletes*: *C. aberrans*, *C. aestivalis*, *C. americanus*.

Key to *Colletes* species of Ontario

Species new for Ontario are designated by an asterisk.
The species descriptions, following m-dash in couplets, involve only the characteristics, which are most important for the recognition of the particular species.
The abbreviations are as followed: F – flagellar segment, T – tergum, S – sternum; administrative subdivisions, states, provinces, and territories, are given according to the recent standards.

Female. Antennae of 12 segments. Clypeal sculpture not hidden by pubescence.

Metasoma and legs are more robust than in males.

1.

Facial fovea maximal width 1.5 – 2.5 times maximal width of scape. Pronotum angulate, without long spines, length of spine not exceed its basal width.

2
- Facial fovea width equal to or less than maximal width of scape. Pronotum angulate or spinose.

6
2.

Metapleura with dorsal carinate projection frequently with testaceous margin. Pubescence completely pale, without dark hairs. – Genal area shorter than eye width. F1 equal to F2 on longer side. Malar area linear. Clypeus slightly convex, shiny, with deep punctures

- longitudinally confluent. Supraclypeal area shagreened, with punctures small and deep. Facial fovea with maximum width twice apical width of scape, triangular. Propodeum postero-laterally tessellate, finely rugose, mid triangle shiny. Scutum with punctures close, deep, their diameter larger than interspaces, with impunctate area posteriorly. Scutellum anteriorly shiny, impunctate. T1 shiny, puncture diameter much less than interspaces, medially punctures scarce. T2 and T3 with punctures small, dense. Hind basitarsi 5 times as long as wide. Body length 8 – 10 mm. ON: VIII-X. Southern Canada; SD, KS, south to FL. ***C. americanus* Cresson**
- Metapleura without dorsal carinate projection. Pubescence with dark hairs. **3**
3. Hind basitarsi 2–2.5 times as long as wide. Genal area 2/3 times as long as eye width. - F1 about twice as long as F2. Clypeus elongate, striate, with longitudinal median impression. Facial fovea twice as wide as scape, subtriangular, with a few small punctures. Malar area linear. Pronotum with short spines. Scutum and scutellum evenly punctured, diameter of punctures greater than space between them, pubescence short, plumose, widely black. Mesopleura with punctures less than diameter apart. T1 – T3 with punctures deep, round, less than diameter apart, discs with deep, short, black, erect hairs. Body length 9 mm. ON: VII-IX. MT, WI, NY, MI, south to FL. ****C. latitarsis* Robertson**
- Hind basitarsi 3-3.5 times as long as wide. Genal area as long as eye width. **4**
4. Terga without white hair bands. — F1 on shorter side equal to F2. Clypeus with close, longitudinally confluent punctures, with basal, median, longitudinal, narrow groove. Facial foveae twice as wide as scape, almost reach ocellus. Thorax on back side with short, plumose, dense, yellow pubescence. Scutum dull, with deep punctures, less than diameter apart, posteriorly interspaces greater. Malar area linear. Mesopleura shagreened, diameter of punctures greater than interspaces, on lower half pits greater, deeper, interspaces flat. Propodeum with posterior surface transversally wrinkled on sides, longitudinally wrinkled on basal part, smooth only on small central triangular area. Legs with dark hairs. T1 shiny, with punctures shallow, 5 and more diameters apart. T2 and T3 with punctures equal to or much greater than puncture diameter apart. T4 – T6 with erect black hairs. Sterna without apical white hair fringe. Hind tarsi 3 times as long as wide. Body length 14 mm. NY, MA, OK, south to FL. ****C. thoracicus* Smith**
- Terga with white hair bands. **5**
5. T1 shiny, punctures almost invisible. Sterna with scopal hairs short, yellowish. — F1 1.5-2 times as long as F2 on shorter side. Clypeus with irregular size, longitudinally confluent punctures. Facial fovea twice as wide as scape, triangular, with smooth, milky surface. Malar area linear, length about 1/4 of width. Genal area equal to eye width. Head between eye and ocelli not impressed. Scutum polished, with punctures one to five diameters apart, disc impunctate. Tegulae dark-brown. Mesopleura shiny, with puncture diameters greater or equal to interspaces, posteriorly punctures smaller, more than apart. Propodeum postero-laterally shagreened, wrinkled. Head, thorax, and legs without dark hairs. T2 and T3 polished, punctures minute. T3 – T5 with erect, black hairs. T6 with deep yellow hairs. Hind basitarsi 4 times as long as wide. Body length 7 – 10 mm. ON: VI-VII. Canada from coast to coast; south to CA. ***C. consors* Cresson**
- T1 shiny, with dense punctures half diameter apart. Sterna with scopal hairs long, white. — F1 1.3 times as long as F2 on shorter side. Facial fovea wide, triangular. Clypeus transversal (3.5/6), with longitudinal, median, impunctate line, punctures small, confluent. Supraclypeal area tessellate, with punctures 1-2 diameters apart. Malar area linear (1/4). Genal area equal

to eye width. Mesopleura shagreened, punctures less than diameter apart on upper part, equal to or greater than puncture diameter on lower part. Propodeum postero-laterally tuberculate. T2 mostly with dense, short, erect, white hairs, with shorter black hairs posteriorly. T3 and T4 with long black hairs. T6 with long redish-yellow hairs. Hind basitarsi 3.5 times as long as wide. Body length 11 mm. ON: VI. Eastern USA, west to IL, south to NC, TE.

..... **C. aestivalis* Patton

6. Pronotum with long lateral spines, length exceeds width at base 7
- Pronotum without long lateral spines 9
7. Scutum rugose, without distinct punctures. — Facial fovea apically curved, widest part equal to apical width of scape. Genal area equal to eye width. F1 equal to F2 on longer side. Scutum and scutellum with hairs short, strongly plumose; on disc pubescence sparse, black; on sides hair dense, yellowish-white. Propodeum with lateral surface shiny, wrinkled. T1 evenly, deeply punctured, with puncture diameter equal to or less than interspaces. Hind basitarsi 4 times as long as wide. Body length 9 – 11 mm. ON: VII-IX. Canada from coast to coast; south to AZ, GA. *C. simulans* Cresson
- Scutum with distinct, separated punctures 8
8. T1 uniformly coarsely, deeply punctured, less than or equal to puncture diameter apart. — Clypeus protuberant, deeply, confluent punctured. Facial fovea width equal to scape apical width, surface shiny. F1 on longer side equal to F2. Genal area equal to half eye width. Head between eye and ocelli flattened, shiny, widely impunctate. Scutum with punctures deep, round, with pit diameter greater than spaces, posteriorly pits larger, the interspaces greater than puncture diameter; pubescence plumose, with admixture of white and black hairs. Scutellar punctures deep, round, with pit diameter less or equal to interspaces, on sides punctures closer. Mesopleura shiny, with deep, confluent pits, interspaces linear. T2-T4 with deeply impressed marginal area. S2 with long, dense, white hairs, sternal fringes thin. Hind basitarsi 3.5-4 times as long as wide. Antennae, mandibles, and legs brown. Body length 9 - 10 mm. ON: VII-IX. CO, MA, WI, south to LA, FL. *C. nudus* Robertson
- T1 with puncture diameter much less than interspaces. — Malar area linear. Clypeus shiny, with deep, longitudinally confluent punctures. F1 longer than F2. Genal area less than or equal to eye width. Facial fovea adjacent to eye, narrower than scape apical width. Head between facial fovea and posterior ocelli with longitudinal impression. Scutum with punctures greater than interspaces on sides, smaller than interspaces on disc, with impunctate area posteriorly. Mesopleura shiny, with puncture deep, interspaces linear. Head, thorax, metasoma, and legs without black hairs. Hind basitarsi 3.5-4 times as long as wide. Body length 8 – 10 mm. ON: VI – VII. Canada from coast to coast; south to CA, NM. **C. hyalinus* Provancher
9. Terga tomentose. Metapleura with dorsal projection more or less hidden with hairs. Scutum with hairs plumose, short, and dense. 10
- Terga not tomentose. Metapleura without dorsal projection. Scutum with hairs thin and long. 11
10. Tergal discs with adjacent to apical hair band space black, without visible hairs, as wide as band. T2 – T5 with short, white, tomentose pubescence on basal part, with spars, long, white hairs on sides. Metapleural projection with yellow margin. — Malar area linear. Clypeus shiny,

- with hairs sparse, erect, thin; punctures of irregular size and shape, longitudinally confluent. F1 on longer side equal to F2. Facial fovea covered with dense hairs, reaches ocellus. Pronotum without lateral spines. Scutellum necked, shiny, impunctate anteriorly. Propodeum with long, dense hairs, basal area necked. Tegulae yellowish-brown, hyaline. Backside with pubescence yellowish. T6 with dark hairs. Sterna without marginal hair fringe. Hind basitarsi 4.5 times as long as wide. Body length 10 mm. ON: VII-VIII. From AB to QC*, south to NM.
- **C. aberrans* Cockerell
- Tergal disc without black space. T1-T5 with yellow tomentose pubescence. Metapleural projection without yellow margin, covered with dense pubescence. — Genal area less than eye width. Malar area linear. F1 longer than F2 on shorter side. Clypeus with central, preapical impression, with punctures confluent, hairs scattered. Supraclypeal area shagreened. Body mostly without black hairs, only T6 with dark hairs. Propodeum with dense, thin, suppressed hairs, postero-laterally tuberculate. Hind basitarsi 4.5 times as long as wide. Body length 7.5-10 mm. ON: VII-VIII. MB; south to NM, TX. **C. wilmattae* Cockerell
11. S6 with lateral, longitudinal, sharp edged ridges. Propodeum with posterior surface broad not divided into horizontal and vertical parts, convex, regularly transversely wrinkled, basally rugose. — Clypeus tessellate, with median, longitudinal impression, punctures smaller than interspaces. Supraclypeal area tessellate, with large deep punctures. Facial fovea width equal to scape width apically. F1 longer than F2. Genal area wider than eye width. Malar area half as long as mandible base. Pronotum with short lateral tooth. Scutum with punctures deep, less than diameter apart, posteriorly impunctate. Scutellar disc impunctate. Dorsum of thorax with hairs plumose, with admixture of black. Mesopleura shiny, with punctures deep, less than diameter apart, posteriorly punctures smaller and closer. T1 with punctures deep, dense to margin, less than diameter apart, anterior vertical surface impunctate. T2 and T3 with widely impressed margin, with punctures similar to T1. T2 with narrow, deep, white hair band basally. T3-T5 with long, erect, black hairs. Hind basitarsi 3.5-4 times as long as wide. Body length 12 – 13 mm. ON: VIII-IX. Canada from coast to coast; south to NM, GA.
- *C. compactus* Cresson
- S6 without lateral ridges. Propodeum divided into basal horizontal and posterior vertical surfaces. 12
12. Mesopleura with shallow punctures, shagreened. 13
- Mesopleura with punctures deep and close, shiny or tessellate. 14
13. Genal area longer than eye width. — F1 equal to F2. Malar area 1/3 as long as mandible base width. Clypeus with longitudinally confluent punctures. Scutum with deep punctures less than diameter apart. Head, scutal, and scutellar pubescence with admixture of black hairs. Pleura tessellate, with shallow, confluent punctures. Propodeum postero- laterally shagreened, closely tuberculate, basally longitudinally wrinkled. T1 with punctures equal to or greater than interspaces. Sterna with white pubescence. Hind basitarsi 4-4.5 times as long as wide. Body length 11.5 – 14 mm. ON: IV – VI. From SK to NS; south to GA.
- *C. inaequalis* Say
- Genal area as long as eye width. — F2 on longer side equal to F1. Clypeus twice as long as wide, shiny, sparsely punctured, with median, longitudinal impression. Malar area twice as long as wide. Head, scutal, and scutellar pubescence with admixture of black. Mesopleura shagreened, striate, punctures shallow. Propodeum laterally shagreened, not tuberculate.

- postero-laterally with sparse, shallow, round pits. T1 with punctures close, small, several diameters apart. Hind basitarsi 4-4.5 times as long as wide. Body length 11-13 mm. ON: IV-VI. Eastern Canada; MI, NY, south to NC. **C. validus* Cresson
14. T1 with deep punctures. **15**
- T1-T4 with punctures obscure. — Genal area equal to eye. Malar area equal to or longer than half mandible base. F2 on longer side equal to or longer than F1. Clypeus shiny, with median longitudinal impression, punctures longitudinally confluent. Supraclypeal area shiny, with punctures greater than or equal to interspaces. Scutum shiny, with punctures deep, merging, posteriorly more widely separated, with impunctate area. Dorsal surface of thorax with admixture of black hairs. Propodeum with basal area short, equal to 1/3 of metanotum; posteriorly rugose, with only lowest part shiny, impressed; postero-lateral surface roughly shagreened. Mesopleura shiny, punctures deep, less than diameter apart. T3-T5 disc with short black and longer white hairs. Hind basitarsi 3-3.5 times as long as wide. Sternal hair fringes dark, thin. Body length 10 mm. ON: V-VIII. Canada from coast to coast; MN, WI, MI, ME.. *C. impunctatus* Nylander
15. Hind basitarsi 4-4.5 times as long as wide. Clypeus shiny, with punctures longitudinally confluent. F1 longer than F2 on shorter side. — Head, thorax, and T1 with ochraceous hairs, thorax dorsally with hairs dense, plumose. Genal area equal to eye width. Malar area shorter than half mandible base width. Scutum with punctures deep, more than puncture diameter apart, posteriorly with impunctate area. Propodeum basally with widely extended, longitudinal striae, creating shiny cells, postero-laterally shagreened, finely wrinkled. Mesopleura with punctures deep, interspaces flat. T1 with deep punctures, with diameters greater than or equal to interspaces. T2 and T3 with punctures minute, dense. T2 with basal, white hair band. T3-T5 with few white erect hairs. Body length 9-10 mm. ON: VI – VIII. Canada from coast to coast; south to CA, NC. *C. kincaidii* Cockerell
- Hind basitarsi 2.5 times as long as wide. Clypeus finely shagreened, with sparse, shallow, small punctures. F1 shorter than F2. — Head, thorax, and T1 with grey pubescence (white and black on back). T1 with punctures deep, 1-3 diameters apart. T2 with punctures dense to margin, disc impressed on basal third. T2 –T5 with thin, sparse, white hairs, longer on T4 and T5. Body length 9-10 mm. ON: VI-VII. Canada from coast to coast; south to TX, FL. *C. willistoni* Robertson

Males. Antennae with 13 segments. Clypeus often with deep, long pubescence.

1. Genal area equal to eye, or wider **2**
- Genal area equal to half eye, or narrower **11**
2. T1 with punctures minute, more than diameter apart. Pronotum without lateral spines. **3**
- T1 with punctures deep and close, diameters greater than interspaces. Pronotum without or with lateral spines. **7**
3. Malar area longer than mandible base. **4**
- Malar area shorter than mandible base. **5**
4. Malar area a little longer than mandible base. — Genal area equal to eye width. F1 equal to F2. Scutum with punctures small, more than diameter apart. Scutum and scutellum without dark hairs. Propodeum with posterior triangle rugose, without shiny space. S3 with central

- basal swelling, S3 and S4 with preapical, lateral swellings. Hind basitarsi 4 times as long as wide. Body length 7 - 8 mm. *C. impunctatus* Nylander
- Malar area twice as long as mandible base. — Genal area equal to eye. Facial fovea less than scape width. Scutum with deep punctures, diameter or less apart. Scutellum with admixture of black hairs. T1 with punctures dense, minute, diameter apart. T3 and T4 with hairs short, erect, black. T4 on posterior part, T5 and T6 with long black hairs. T7 with deep, short, suppressed, white hairs and sparse, long black hairs. Tergal hair bands narrow, on T2 and T3 equal to 1/5 of tergal length. Sterna without swellings. Hind basitarsi 5 times as long as wide. Body length 11-13 mm. *C. validus* Cresson
5. Malar area longer than half mandible base. 6
- Malar area shorter than half mandible base. — F1 equal to F2. Scutum shiny, with puncture diameter less than or equal to interspaces, disc with impunctate area. Mesopleura shiny, with punctures shallow, one-half to one diameter apart. T1 shiny, finely punctured. T1 and T2 discs with long, white hairs. T3-T6 with long black hairs. Sterna with apical hair fringe longer on sides. Hind basitarsi 3-3.3 times as long as wide. Body length 7-8 mm.
..... *C. consors* Cresson
6. Mesopleura shagreened, punctures shallow, interspaces linear on upper half, flat on lower part. — Malar area equal to 2/3 mandible base width. F1 wider than long, half as long as F2. Genal area as long as eye. Scutum with punctures greater than interspaces, interspaces wider posteriorly. Propodeum wrinkled laterally and posteriorly. Tegulae yellowish, hyaline. T1-T4 shiny, with punctures one to two diameters apart. T1 and T2 disks with long, white hairs. T3-T5 with shorter black and longer white hairs. Hind basitarsi 4 times as long as wide. Body length 11-13 mm. *C. thoracicus* Swenk
- Mesopleura shiny, punctures deep, interspaces linear on upper part, flat on medial part. — F1 shorter than F2. Genal area as long as eye. Scutum shiny, with punctures smaller than interspaces, with impunctate area posteriorly. Mesopleural punctures deep, less than diameter apart. T1-T5 shiny, with minute punctures. T2 with long, white hairs. T3-T5 with black hairs. Hind basitarsi 4-4.5 times as long as wide. Body length 8 - 9 mm.
..... **C. hyalinus* Provancher
7. Malar area longer than base of mandible. — Propodeum with posterior surface transversely wrinkled. Clypeus shiny, sparsely punctured, with median longitudinal impression. Genal area as long as eye. F1 2/3 as long as F2. Pronotum without lateral spines. Scutum with punctures less than diameter apart, with impunctate area. Dorsal surface of thorax with admixture of dark hairs. Terga with marginal area abruptly depressed, with or without black hairs on disc. Hind basitarsi 5 times as long as wide. Body length 9 - 12 mm.
..... *C. compactus* Cresson
- Malar area equal to or shorter than base of mandible. 8
8. Hind basitarsi twice as long as wide. S5 and S6 with margins incurved. Pronotum with long lateral spines. — F1 equal to F2 on longer side. Clypeus elongate, flat, confluent sculpture, with central longitudinal depression, short pubescence sparse, not hiding sculpture. Malar area half as long as mandible base. Tegulae dark. Mesopleura with punctures deep, interspaces linear. Scutum with pubescence dense, short, plumose, with admixture of black hairs. T1 with evenly dense punctures, less than diameter apart. T2 and T3 discs with hairs short, black. T4-T6 with hairs long, erect, black. Fore femur with brush of white hairs, twice as long as tibia. Body length 9 mm. **C. latitarsis* Robertson

- Hind basitarsi 3.5 – 5 times as long as wide. S5 and S6 with margins almost straight Pronotum without lateral spines. **9**
- 9. T2-T7 discs without white hairs. — F1 equal to F2. Malar area linear. Genal area wider than eye. Clypeus twice as wide as long, roughly shagreened, with hairs short, do not hide surface. Head and thorax dorsally with deep, orange hairs. Tegulae black. T1-T5 with narrow, white hair band. T1 with punctures small, deep, 2-5 diameters apart; pubescence thin, short, white. T2-T7 with dense, erect, black hairs. Metasoma concave ventrally. Sterna with lateral, long, white hair brush. Hind basitarsi 3.5 times as long as wide. Body length 10-12 mm. ***C. aestivalis Patton**
- Tergal discs with white hairs. **10**
- 10. Mesopleura shagreened, shallowly sculptured. — F1 equal to half F2 on longer side. Malar area as long as mandible base width. Genal area wider than eye. T2 – T5 with hairs long, erect, white. T6 with long, black hairs. Sterna with marginal fringes enlarged on sides, narrow medially. Hind basitarsi 4-4.5 times as long as wide. Body length 11 – 13 mm. **C. inaequalis Say**
- Mesopleura shiny, with punctures deep, close, interspaces flat.— F1 longer than half F2. Malar area equal to or little shorter than width of mandible base. Genal area as wide as eye. Tergal pubescence without black hairs. Sternal fringes medially enlarged on disc. Hind basitarsi 4-4.5 times as long as wide. Body length 8-10 mm. **C. kincaidii Cockerell**
- 11(1). Pronotum with long lateral spines, length of which exceeds width at base. **12**
- Pronotum without long lateral spines. **13**
- 12. Scutum rugose. T2 and T3 with marginal area not abruptly depressed. F1 longer than half F2. — Genal area wider than half eye. Malar area equal to or shorter than half mandible base. Propodeum with postero-lateral surface rugoso-wrinkled. Mesopleura with punctures deep, close, interspaces linear on lower part, punctures confluent on upper part. Dorsum of thorax with pubescence dense, long, yellowish, with admixture of black hairs. T1 with punctures dense, deep, diameter or more apart. T2 and T3 with punctures smaller and deeper. Sterna with hair fringes longer laterally. Hind basitarsi 5 times as long as wide. Body length 8 - 10 mm. **C. simulans Cresson**
- Scutum with deep, round, clearly separated punctures. T2 - T4 with marginal area abruptly depressed. F1 transversal, as long as half F2, or shorter.— Genal area shorter than half eye width. Malar area linear, equal to or shorter than 1/3 mandible base. Mesopleura with punctures large, deep, merged anteriorly, interspaces wider on median part. Scutal and scutellar pubescence short, not hiding surface, grey with admixture of black hairs. Propodeum posteriorly shiny, with fine transversal wrinkles. T1 shiny, with punctures deep, more than diameter apart. T2 and T3 with punctures diameter or more apart. Hind basitarsi 4-4.3 times as long as wide. Antennae, mandibles, and legs brown. Body length 8 – 10 mm. **C. nudus Robertson**
- 13. Metapleura without overhanging projection. — Malar area half as long as mandible base. T1 with punctures deep, close, less than diameter apart. F1 equal to F2 on shorter side. Genal area as long as half eye width. Clypeus flat, tessellate, punctures shallow, close, confluent. Mesopleura with punctures deep, interspaces linear. Terga with marginal area strongly impressed. Head and thorax with grey hairs, with admixture of black on scutum. Scutum with

- punctures deep, well separated, less than diameter apart. Hind basitarsi 3 times as long as wide. Sterna with long hair fringe. Body length 8 – 9 mm. *C. willistoni* **Robertson**
- Metapleura with dorsal overhanging projection. **14**
14. T1 disc with punctures sparse, minute, few diameters apart — Malar area linear, length about 1/4 width. F1 shorter than F2. Genal area half as long as eye width. Clypeus densely pubescent. Head, scutum, and metasoma without black hairs. Mesopleura with punctures merged on upper part, interspaces flat on lower half. T2 and T3 shagreened, with minute, dense punctures. Terga with margin widely hyaline. Tarsi yellowish. Hind basitarsi 5-6 times as long as wide. Body length 7- 10 mm. *C. americanus* **Cresson**
- T1 with deep punctures, less than diameter apart. **15**
15. T2 without basal fasciae. Genal area as long as half eye width. Malar area half as long as mandible base width. — F1 shorter than F2. Head and thorax without black hairs. Scutum with punctures greater than interspaces, on disc punctures 2 3 diameters apart. Propodeum posteriorly wrinkled. T2 and T3 with deep, dense punctures, less than diameter apart. Hind basitarsi 4 times as long as wide. S2-S4 discs with median, premarginal, triangular depression, mostly covered with short, white hairs. Body length 8-10 mm. *C. aberrans* **Cockerell**
- T2 with broad, basal, white hair fasciae. Genal area as long as eye width. Malar area as long as 1/3 mandible base width.— F1 shorter than F2. Scutum with dense, thin, yellowish-grey hairs. Propodeum posteriorly with sparse, thin, long hairs, laterally with long hairs, postero-lateral surface tuberculate. Mesopleura tessellate, with pits deep, dense, interspaces linear. Femur and tarsi yellow. Hind basitarsi 4.5-5 times as long as wide. Terga without black hairs. Sterna with lateral swellings. Body length 8-9 mm. *C. wilmattae* **Cockerell**

Annotated List of Ontario *Colletes* species.

The species are listed in alphabetical order. Locality records are grouped by Districts and Counties from north to south. Distributional data and the flight period are included in the female key; i.e., “ON: VIII-X” means flight period in Ontario is from August to October.

The abbreviations are as follows: collector’s names: AR (W. Attwater), AT (C. Atwood), BG (N. Bigelow), BK (M. Buck), BL (S. Beiley), BR (K. Barber), CL (S. Clark), ED (C. Edwards), KL (L. Kelton), KN (G. Knerer), LM (R. Lambert), MF (R. MacFarlane), MK (P. MacKay), MN (J. Martin), PA (S. Paiero), PG (D. Pengelly), RL (K. Ralph), RM (T. Romankova), SL (F. Sladen), US (M. Usui); depositories: CASC (California Academy of Sciences, San Francisco), CNC (Canadian National Collection of Insects, Ottawa), GU (University of Guelph, Guelph), INHS (Illinois Natural History Survey, Champaign), ROM (Royal Ontario Museum, Toronto), UCRC (University of California, Riverside), USNM (Smithsonian Institution, Washington).

1.Colletes aberrans* Cockerell.**

Essex Co.: Point Pelee, 30.VII.1978, ♂, AR, ♂, J. Cappleman (DEBU); 13.VII.1982, ♀, A. John (DEBU). Figure 1.

2.C. aestivalis* Patton.**

Essex Co.: Pelee Island, Stone Road Alvar FON Reserve, 41°45’20” N 82°7’ 20”, 8.VI.2002, ♂, S. Marshall; 9.VI.2002, 2♂, PA, BK (DEBU).

Reviewed materials from other regions. IL, Dubois, 21.V.1917, ♀ (UCRC). NC, Bryson City, 1.VI.1923, ♀, ♂, J. Crawford (UCRC). Figure 1.

3. *C. americanus* Cresson.

Carleton Co.: Metcalfe, 27.IX.1982, ♀, B. Cooper (CNCI). **Northumberland Co.:** Alderville First Nations Prairie, 1.IX.2001, ♀, PA (DEBU). **Durham Co.:** Kendal, 1.IX.1960, ♂, KN; 27.VIII.1961, 2♂, KN (ROME). **Dufferin Co.:** Mono Cliffs Provincial Park, 31.VIII.2002, ♂, BK (DEBU). **Peel Reg.:** Forks of the Credit, 18-29.VIII.1968-1969, 51♂, MK; 12-20.IX.1969, 3♀, MK, *Solidago* sp. (ROME); Belfountain, 16.IX.1979, ♂, S. Marshall GU). **Wellington Co.:** Guelph, 13.IX.1969, ♀, T. Taylor (DEBU). **Elgin Co.:** Iona, 22-25.VIII.1968-1969, 2♂, KN (ROME). Figure 1.

4. *C. compactus* Cresson.

Lanark Co.: Prospect, 13.IX.1969, ♀, L. Smith (CNCI). **Hastings Co.:** Belleville, 10.IX.1982, ♀, W. Punchihewa (DEBU). **Simcoe Co.:** Midland, 11.IX.1970, 2♂, J. Huber (DEBU). **York Reg.:** Newmarket, 27.IX.1970, ♀, G. Surgeoner (DEBU); Leaside, 12.VIII.1961, ♂, G. Morris (DEBU). **Dufferin Co.:** Mono Cliffs Provincial Park, 31.VIII.2002, 3♂, BK (DEBU). **Peel Reg.:** Forks of Credit, 3-29.IX.1969, 39♀, 44♂, MK, *Solidago* (ROME); Belfountain, 1.IX.1982, ♂, W. Funchibewa; 16.IX.1979, ♀, S. Marshall (DEBU). **Wellington Co.:** Guelph, 10.IX.1993, ♂, X. Sun; 21.VIII.1978, ♂, B. Warner; 2.X.1975, 2♀, MF; 2.X.1972, 2♀, ♂, MF; 26.IX.1971, ♀, MF; 16.IX.1970, ♀, T. Taylor (DEBU). **Essex Co.:** Windsor, Ojibway Prairie, 22.IX.2001, ♂, S. Marshall (DEBU); Point Pelee, Mono Cliffs, 4.IX.1995, ♂, Middleton (DEBU). **Ontario, 1979, ♂♀, B. Termir.** Prescott, 7.IX.1978, ♂, BR (DEBU). Figure 2.

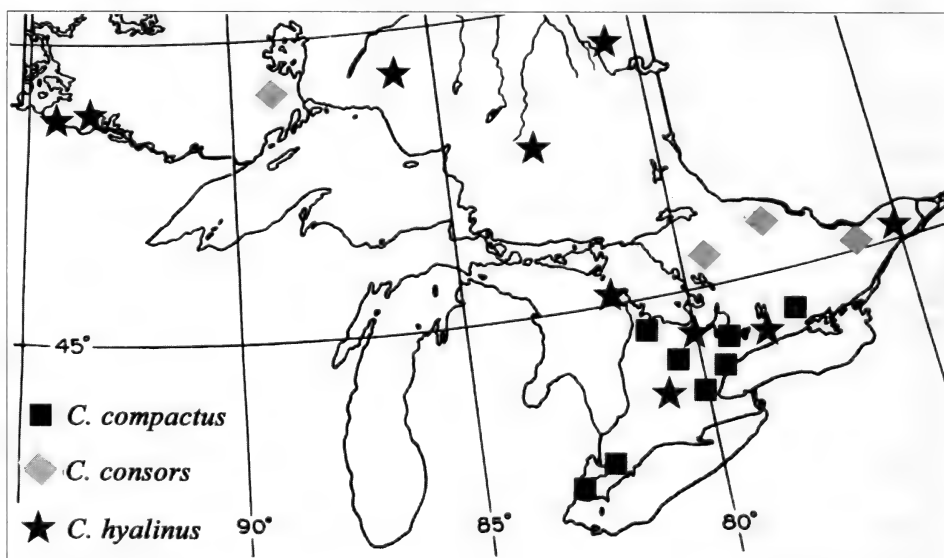


FIGURE 2. Ontario collection localities of *Colletes*: *C. compactus*, *C. consors*, *C. hyalinus*.

5. *C. consors* Cresson.

Kenora Distr.: Black Sturgeon Lake, 1.VII.1962, ♀ (CNCI); Oneside Lake, 1.VII.1960, ♀, CL (CNCI). **Thunder Bay Distr.:** Sleeping Giant Provincial Park, 48°20'53"N 88°48'11"W, 9.VII.2002, ♂, BK (DEBU). **Cochrane Distr.:** Abitibi Lake, Low Bush, 21.VII.1925, 3♀, BG

(ROME). **Timiskaming Distr.:** Cobalt, 1.VII.1960, ♀ (ROME). Carleton Co.: Ottawa, 20.VI.1973, 2♀, E. Small (CNCI). **Lennox & Addington Co.:** Kaladar, 14.VI.1960, ♀ (ROME). **Muskoka Distr.:** Port Sydney, 23.VI.1897, ♂ (CNCI). Figure 2.

Reviewed materials from other regions. Type *Colletes pascoensis* Cockerell, WA, Pasco, 25.VI.1916, ♂, (USNM). Paratype *Colletes mesocopus* Swenk, ME, Waldober, VII.1904, ♀, J. Lovell (USNM).

6.**C. hyalinus* Provancher.

Kenora Distr.: Kenora, 28.VI.1984, ♂, R. Jaagumagim (ROME); Favourable Lake., 20.VI.1938, ♂, Neal (ROME). **Rainy River Distr.:** 3.VIII.1960, ♀, CL (CNCI). **Cochrane Distr.:** Cochrane, 9.VIII.1917, ♀, SL (CNCI); Abitibi Lake, Low Bush, 14-21.VII.1925, 4♀, BG (ROME). **Algoma Distr.:** Frances, 11.VII.1961, 3♀, H. Milliron (CNCI). **Sudbury Distr.:** Emo, 3.VII.1917, ♀, SL (CNCI); Chapleau, 18-24.VII.1990, 3♂, US, Early Goldenrod (DEBU). **Muskoka Distr.:** Port Sydney, 4-9.VII.1919, 2♀, 2♂, BG (ROME). **Carleton Co.:** Ottawa, 24.VI-26.VII.1913, 4♂, SL (CNCI). **Peterborough Co.:** Cordova, 10.VII.1959, ♀, CL (CNCI). **Durham Co.:** 16.VI.1987, ♂, B. Hubley (ROME); Kendal, 12.VII.1961, ♀, ♂, KN (ROME). **York Reg.:** Keswick, 1.VI.1975, ♀, Sowinsk (DEBU). **Bruce Co.:** Dyers Bay, 30.VI.1955, 24.VI-30.VII.1954, 26♀, ♂, PG; 8-16.VII.1953, 7♂, PG; 10.VII.1952, 12♀, 15♂, PG (DEBU). **Dufferin Co.:** Orangeville, 17.VII.1961, ♀, KN (ROME); 9.VII.1954, ♂, PG (DEBU); Primrose, 7.VII.1960, ♂, PG; 17.VII.1956, ♀, PG; 30.VI.1955, ♀, PG (DEBU). **York Reg.:** Toronto, 3.VII.1917, ♀, SL (CNCI). **Essex Co.:** Point Pelee, 25.VII.1979, ♀, AR (DEBU). Figure 2.

Reviewed materials from other regions. Holotype, Allotype, and 5 other Paratypes *Colletes aregonensis* Timberlake, OR, CA (CASC).

7. *C. impunctatus* Nylander.

Kenora Distr.: Black Sturgeon Lake, 8.VII.1964, ♀ (CNCI). **Thunder Bay Distr.,** Sleeping Giant Provincial Park, Gardner Lake trail, 48°25'N 88°46'W, 11.VII.2002, 2♂, BK (DEBU). **Cochrane Distr.:** Abitibi Lake, Low Bush, 17.VII.1925, 2♀, BG (ROME). **Sudbury Distr.:** Chapleau, Racine Lake, 6-22.VII.1990, 17♀, 19.VI.1990, ♂, US, 10.VI.1992, ♂, US, *Chamerion*, *Trifolium*, Coe Vetch, Red raspberry, Early goldenrod, Alsike clover (DEBU). **York Reg.:** Toronto, 16.VI.1908, ♂ (CNCI), 12.VIII.1887, ♀ (DEBU). Figure 3.

8. *C. inaequalis* Say.

Thunder Bay Distr.: Stirling, 17.V.1963, ♀, A. Johnson (DEBU). Watershed, 17.V.1962, ♂, KN, *Chamaedaphne* (ROME). **Algoma Distr.:** Sault Ste. Marie, 4.VI.1948, 2♀, AT (ROME); Garden River, 28.IV.1951, 4♂, AT (ROME). **Sudbury Distr.:** Chapleau, 18.V.1990, 2♂, US, *Salix* sp. (DEBU); Peach Lake, 4-21.V.1962, 2♀, ♂, KN, *Vaccinium* (ROME). **Nipissing Distr.:** Kearney, 6.V.1977, 3♂, A. Konecny (DEBU). **Parry Sound Distr.:** Kearney, 6.V.1977, ♂ (DEBU). **Lanark Co.:** Perth, 12-31.V.1962, 5♀, ♂, KN, *Prunus*, *Salix* (ROME); Maberly, 17.IV.2002, ♀, BK (DEBU). **Carleton Co.:** Ottawa, 23.IV.1976, ♂, Cumming; 3-9.V.1914, 3♂, SL (DEBU); 19.IV.1973, ♀, E. Small; 24.IV-21.V.1913, 2♂, SL (CNCI); Constance Bay, 27.IV.1944, 2♀, 10♂ (CNCI). **Grenville Co.:** Spencerville, 17.V.1938, 2♀ (CNCI); 12.V.1955, ♀, H. Huckel (DEBU). **Leeds Co.:** Opinicon, 12-28.V.1962, ♀, 5♂, KN, *Salix*, *Amelanchier* (ROME). Chaffey's Locks, 25.V.1961, ♀, J. Morris (DEBU); 24.V.1961, ♀, KN, *Brassica* (ROME); Morton, 19.V.1971, 2♀ (CNCI). **Lennox & Addington Co.:** Kaladar, 22.V.1971, ♀, ♂, S. Vander Kloet, *Vaccinium angustifolium* (ROME). **Haliburton Co.:** Algonquin Park, Swan Lake, 1-7.VI.1994, ♀, E. Barr; 5.VI.1945, ♀, PG (DEBU). **Haliburton & Muskoka Distr.:** Dorset, 6.V.1995, ♂, R. Russell

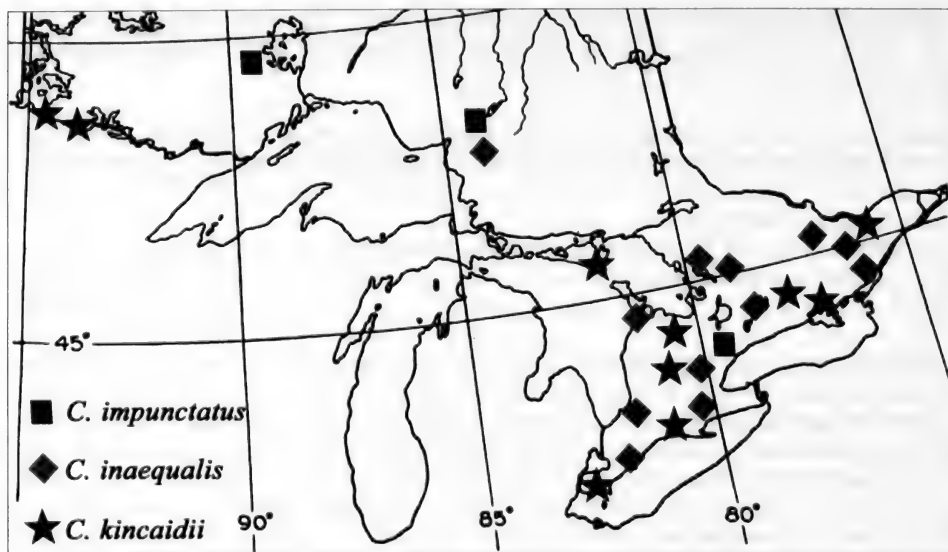


FIGURE 3. Ontario collection localities of *Colletes*: *C. impunctatus*, *C. inaequalis*, *C. kincaidii*.

(DEBU); 21.V.1962, 3♀, KN, *Prunus* (ROME). **Muskoka Distr.:** Severn Bridge, 12.IV.1968, 7♀, 13♂, G Scott (ROME). **Peterborough Co.:** Peterborough, 20.IV.1977, ♀, B. Smith (DEBU). **Durham Co.:** Kendal, 22.IV–4.V.1962, 2♀, 2♂, KN, *Salix* (ROME). **Simcoe Co.:** De Grassi Point, 2.V.1916, 2♂, E. Whettr (ROME). **York Reg.:** Maple, 25.IV.1962, ♀, KN, *Salix* (ROME); Toronto, 9.V.1893, ♂ (DEBU); **Bruce Co.:** Paisley, 18.IV.1976, 3♂, S. Marshall (DEBU). **Peel Reg.:** Forks of the Credit, 21–30.IV.1969, 42♀, 3♂; 29.V.1969, ♀, MK, *Salix*, *Malus*; 21.IV.1962, 3♀, 16♂, KN, *Claytonia*; 21.VI.1962, ♀, KN (ROME). Westport, 25.V.1961, ♀, KN, *Malus* (ROME). **Bruce Co.:** Hepworth, 7.V.1995, ♀, ♂, D. Caloren; 30.V.1978, 2♀, D. Caloren (DEBU). **Grey Co.:** Owen Sound, 23.IV.1985, ♂, R. Sinclair (DEBU). **Wellington Co.:** Guelph, 30.IV.1977, ♀, RL; 1.V.1974, ♀, B. Akey; 13.V.1972, ♀, MF; 21.IV–1.V.1972, 2♂, MF, *Gyacinth*; 3–15.V.1965, 6♀, 4♂, ED; 24.IV.1960, ♀, N. LeBlanc (DEBU). **Huron Co.:** Kinburn, 13.V.1956, ♀, J. Martin (CNCI). **Wentworth Co.:** Ancaster, 15.IV.1963, 10♂, J. Martin; 21.V.1956, ♀, J. Martin (CNCI). **Middlesex Co.:** Strathroy, 10.V.1927, 2♀, H. Hudson (CNCI). **Norfolk Co.:** St. Williams, 20.V.1995, ♀, D. Caloren (DEBU); Port Dover, 25.VI.1959, ♀, PG (DEBU). **Essex Co.:** Point Pelee, 8.IX.1954, ♀, Mason (CNCI). Well Luther M. (=Luther Marsh), 10.IV.1998, ♀, D. Tozer (DEBU). Figure 3.

9. *C. kincaidii* Cockerell.

Rainy River Dist.: Rainy River, 1.VIII.1924, ♀, Brimley (CNCI); Fort Frances, 11.VII.1961, 5♀, Milliron (CNCI). **Thunder Bay Distr.:** Strathroy, 2.VII.1925, ♂, H. Hudson (CNCI). **Carleton Co.:** Ottawa, 8–23.VII.1913, ♂, ♀, SL (CNCI); 24.VI.1913, ♂, SL (DEBU). **Leeds Co.:** Chaffey's Locks, 5.VII.1963, 9♂, Riette (ROME). **Muskoka Distr.:** Port Sydney, 9.VII.1919, ♀, BG (ROME). **Victoria Co.:** Cobocok, 18.VII.1961, ♀, ♂, KN, *Melilotus* (ROME). **Northumberland Co.:** Crowe Bridge, 18.VII.1979, ♀, AR (DEBU); Brighton, 29.VI.1979, ♀, Appleby (DEBU). **Prince Edward Co.:** 1.VII.1896, 2♀, Evans (CNCI). **Durham Co.:** Kendal, 7.VI.1962, ♂, KN; 12.VII.1961, 5♀, KN (ROME). **Simcoe Co.:** Swift Rapids Road, Lake Matchedash, 17.VII.1996,

♂, B. Larson (DEBU); Midland, 9.VIII.1977, 2♂, BR (DEBU); Orillia, 20.VII.1923, ♂ (CNCI); Barrie, 16.VII.1961, ♀, KN, *Rhus* (ROME). **York Reg.:** Leaside, 7.VII.1959, 2♂ (ROME). **Bruce Co.:** Hepworth, 16.VII.1974, ♂, J. Huber (DEBU); Dyers Bay, 7-30.VII.1953, 2♀, 3♂, PG; 11.VII.1913, ♀, SL (DEBU); Bruce Peninsula, 10.VII.1960, ♂ (ROME). **Dufferin Co.:** Primrose, 17.VII.1956, ♂, PG; 30.VI.1955, 7♂, PG (DEBU); Orangeville, 17.VII.1961, ♂, KN (ROME). **Peel Reg.:** Forks of Credit, 27.VIII.1968, ♂♂, KN; 11-22.VII.1969, 3♀, MK; 18.VII.1968, ♀, MK; 4.VII-1.VIII.1968-1969, 47, MK; 24-28.VI.1965, 3♀, ♂♂, KN (ROME); **York Reg.:** Toronto, 21.VII.1891, 5♀, ♂; 17.VI-2.VII.1888, 4♀, 7♂ (CNCI); 27.VI.1965, ♂, KN; 1.VIII.1890, ♂, W. Brodie (ROME). **Wellington Co.:** Guelph, 30.VII.1980, ♀, Beierl; 31.VII.1978, ♀, B. Warner; 15.VII.1976, ♂, Waters; 15.VIII.1976, ♂, Stewart; 19.VII.1965, ♂, ED (DEBU); Speedside, 20.VIII-7.IX.1965, 2♀, 3♂, ED (DEBU). **Huron Co.:** Goderich, 20.VII.1977, ♂, D. Meddisson (ROME). **Wentworth Co.:** Borer's Falls, 14.VIII.1978, ♀, B. Warner (DEBU). **Durham Co.:** Port Perry, 1.VIII.1934, ♀ (ROME). **Norfolk Co.:** St. Williams, 30.VI.2000, ♂, BK (DEBU). **Kent Co.:** Fargo, 20.VII.1959, ♀, PG (DEBU). **Essex Co.:** Point Pelee, 31.VII.1960, ♂, KN (ROME); 19.VII-2.VIII.1920, 2♀, 3♂, BG (ROME); 25.VII.1979, ♀, AR; 18.VII.1978, ♂, BR (DEBU); 9-17.VII.1962, 2♀, CL; 19.VII.1920, 2♂, BG (CNCI). ? Co.: Pigeon Lake, 17.VII.60, ♀, Chuan (DEBU). Figure 3.

10.**C. latitarsis* Robertson.

Renfrew Co.: Griffith, 2.VIII.1982, ♀, Cooper (CNCI). **Carleton Co.:** HWY 16, Ottawa, 15.VIII.1994, ♀ (CNCI). **Durham Co.:** Kendal, 12.VII.1961, ♂, KN (ROME). **Grenville Co.:** Prescott, 7.IX.1978, ♂, BR (DEBU). **Simcoe Co.:** Midland, 8.VIII.1977, ♀, BR (DEBU). **Wellington Co.:** Guelph, 1.VII.1977, ♂, RL (DEBU); Elora, 16.VIII.1976, 2♀, Sharkey (DEBU). **Norfolk Co.:** St. Williams, 25.VII.2000, ♂, BK (DEBU). **Kent Co.:** Rondeau Park, 14.VII.1962, 2♂, CL (CNCI); Chatham, 20.VII.1948, ♂, MN; 14.IX.1927, ♀, C. Smith (CNCI). **Essex Co.:** Point Pelee, 24.VIII.1961, ♀, KN, *Malva*; 9.VII.1920, ♂, BG (ROME). Long Point, 5.VIII.1978, ♀, V. Husby (DEBU). Figure 4.

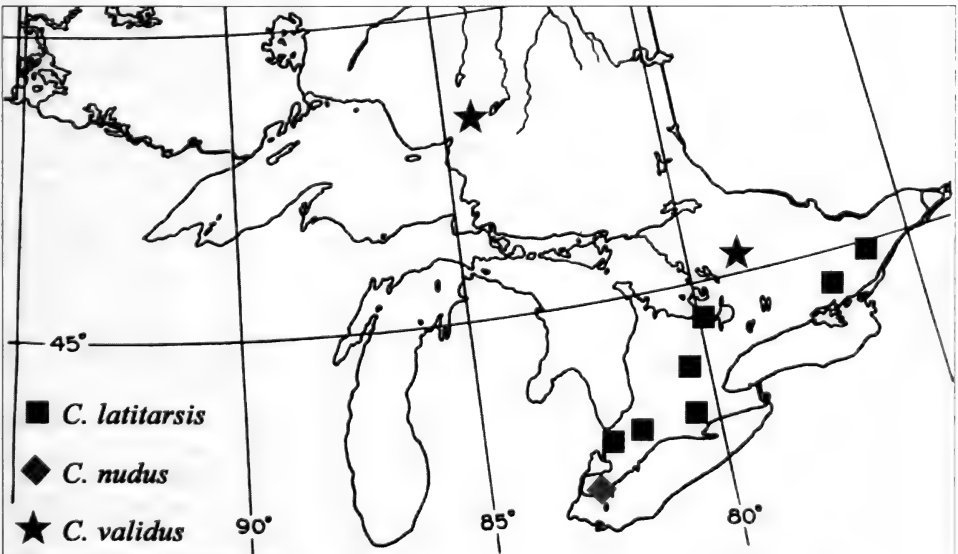


FIGURE 4. Ontario collection localities of *Colletes*: *C. latitarsis*, *C. nudus*, *C. validus*.

11. *C. nudus* Robertson.

Victoria Co.: Norland, 18.VII.1961, ♂, KN (ROME); Coboconk, 18.VII.1961, ♂, KN; 6.VII.1963, ♀, KN, 14.VIII.1961, 2♀, KN, *Solidago*; 18.VII.1961, 3♀, KN, *Rhus*, *Melilotus* (ROME). **Durham Co.:** Kendal, 13.VII.1978, ♀, Shefter (ROME). **Wellington Co.:** Guelph, 2.X.1984, ♂, T. Young, *Aster*; 10.VIII.1951, ♂, PG (DEBU). **Essex Co.:** Point Pelee, 20.VII.1978, ♂, D. Morris (DEBU). 24.VII.1979, ♀, ♂, AR, B. Witt; 25.VII.1979, ♂, AR (DEBU); 19.VII.1920, 2♂, BG (CNCI); 19.VII.1920, 5♂, BG (ROME). Figure 4.

12. *C. simulans* Cresson.

Algoma Distr.: Spanish, 19.VII.1957, ♀, M. Prime (DEBU). **Sudbury Distr.:** Chapleau, Racine Lake, 22.VII.1990, ♀; 12-28.VIII.1990, 19♀, 3♂, US, Early Goldenrod (DEBU). **Manitoulin Distr.:** Killarney Park, 17.VIII.1978, 2♀, 4♂, AR (DEBU). **Nipissing Distr.:** Penaish Lake, 2.VIII.1946, 4♂, 2♀, AT (ROME); Algonquin Provincial Park, East Gate, 20.VIII.2002, 3♀, BK (DEBU). **Lanark Co.:** Perth, 25.VIII.1957, ♀ (CNCI); Rosetta, 20.VIII.1978, ♀, E. Fuller (ROME). **Muskoka Distr.:** Port Sydney, 24.VIII.1919, ♂, BG (ROME). **Carleton Co.:** Ottawa, 30.VIII-13.IX.1913, 5♀, SL (CNCI); 23.VIII.1914, ♀, SL (DEBU). **Halton Reg.:** Georgetown, 29.VIII.1893, ♀ (DEBU). **Stornmont Co.:** Cornwall, 1.IX.1961, 2♀, KN (ROME). **Grenville Co.:** Spencerville, 31.VIII-14.IX.1939, 7♀, Hammond (CNCI). **Leeds Co.:** St. Lawrence Isl. N. Park, 26.VIII-14.IX.1976, 49♀, ♂ (CNCI). **Haliburton & Muskoka Distr.:** Dorset, 1.IX.1976, 2♀, PG (DEBU); 16.VIII.1961, 13♂; 18.VIII-3.IX.1961, 3♀, KN, *Solidago* (ROME). **Haliburton Co.:** Carnarvon, 17.VIII.1961, 2♀, KN (ROME). **Muskoka Distr.:** Rostrevor, 7.IX.1907, ♀ (CNCI); Georgian Bay, 26.VIII.1963, ♂, J. Bogard, 15-26.VIII.1953, 3♂, J. Bogart (DEBU). **Peterborough Co.:** Cox Lake, 10.IX.1960, ♂, KN, *Solidago* (ROME). **Victoria Co.:** Bobcaygeon, 29.VIII.1954, 10♀, LM (CNCI); Norland, 14.VIII.1961, 3♂, KN, *Solidago* (ROME). **Northumberland Co.:** Brighton, 14.IX.1954, 2♀, MN (CNCI). **Durham Co.:** Port Hope, 20.VIII.1963, 2♂, J. VanLoon (DEBU); 20.VIII.1925, 2♀, BG (ROME); Orono, 3.IX.1925, 9♀, BG (ROME); Kendal, 25.VIII.1960, 7♂, WG; 27.VIII.1961, 3♀, KN; 1.IX.1960, ♀, KN (ROME); 23.VIII.1963, ♀, J. VanLoon (DEBU). **Simcoe Co.:** Severn, 8.VIII.1919, ♀ (CNCI); Springwater Provincial Park, 2.IX.2002, ♀, BK (DEBU). **York Reg.:** Keswick, 5.VIII.1975, ♂ (DEBU). **Bruce Co.:** Dyers Bay, 13-23.VIII.1953, 14♀, 8♂, PG.; 21.VIII.1952, ♀, ♂, PG (DEBU); Hepworth, 1.VIII.1975, ♂, J. Huber (DEBU); Sauble Beach, 1.VIII.1977, ♀, B. Marshall (ROME). **Dufferin Co.:** Orangeville, 19.VIII.1954, 2♀, PG; Mono Cliffs Provincial Park, 31.VIII.2002, ♀, BK (DEBU). **Peel Reg.:** Forks of the Credit, 8-20.VIII.1968, 8♂, 15.VIII.1969, ♂; 20.IX.1969, ♀; 27.VIII.1968, ♀, *Solidago* (ROME); **York Reg.:** Toronto, 13.VIII.1959, ♀; 20.IX.1934, 2♀ (ROME); 7-16.IX.1891, 2♀; 30.VII-15.VIII.1893, 2♂ (CNCI). **Wellington Co.:** Speedside, 18.VIII.1965, 3♀, ♂, ED (DEBU); Guelph, 16.VIII.1981, ♂, G. Grant; 30.VIII.1978, ♀, MF; 4.IX-2X.1972, 3♀, ♂, MF; 17.IX.1963, ♀, J. Macklin, *Solidago*; 10.VIII.1951, ♂, PG; 23.VIII.2002, ♀, BK, *Solidago* (DEBU). **Halton Reg.:** Burlington, 6.X.1981, ♀, B. Sinclair; 3.VII.1981, ♀, J. Thomson (DEBU). **Brant Co.:** Brantford, 18.IX.1961, ♂, J. Morris; 14.IX.1956, ♀, T. Armstrong (DEBU). **Haldimand-Norfolk Reg.:** Delhi-Simcoe Railway, 7.IX.2001, ♀, PA (DEBU). **Haldimand Co.:** Dunnville, 3.IX.1954, 12♀, LM (CNCI). **Middlesex Co.:** Parkhill, 6.IX.1954, 6♀, C. Miller (CNCI); London, 10.IX.1963, ♀, KN (ROME). **Elgin Co.:** Iona, 22.VIII.1961, ♂, KN (ROME). **Norfolk Co.:** Normandale, 4.IX.1954, 2♀, LM (CNCI); Port Dover, 4.IX.1954, 3♀, LM (CNCI). **Lambton Co.:** Grand Band, 6.IX.1954, 4♀, LM (CNCI); Pinery Provincial Park, 18.IX.1994, ♀, J. Skevington (DEBU). **Essex Co.:** Point Pelee, 9.IX.1954, ♀, W. Mason (CNCI); 24.VII.1979, ♀, AR; 19.VII.1978, ♀, J. Cumming (DEBU); Windsor, Ojibway Prairie, 30.VIII.2001, ♀, PA; 14-18.VIII.2001, ♀, PA (DEBU). Ontario, 22.VIII.1938, ♀, Smith (DEBU). Figure 5.

Reviewed materials from other regions. Neotype *Colletes armatus* Patton, NH, Pelham, 2.VIII.1905, ♀, Bridwell (USNM).

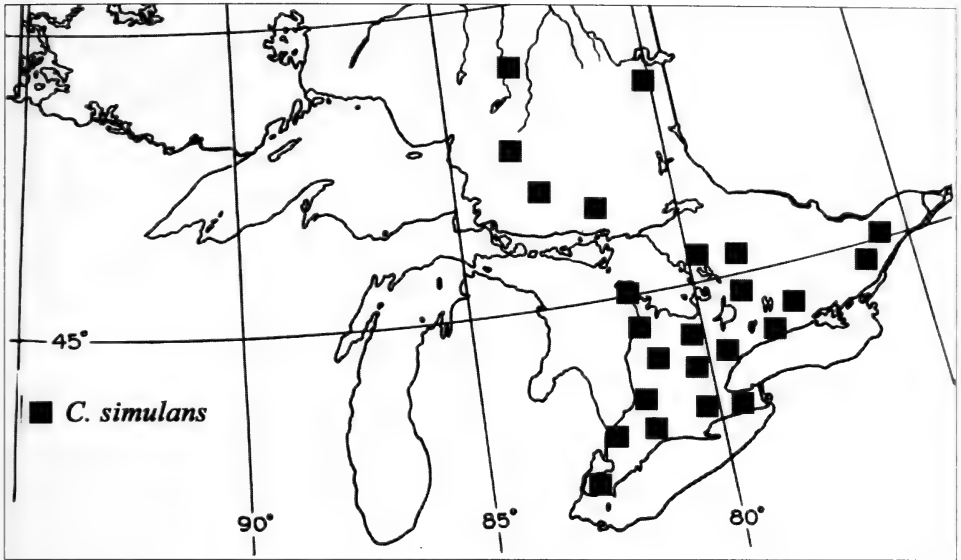


FIGURE 5. Ontario collection localities of *Colletes simulans*.

13.**C. thoracicus* Smith.

Grey Co.: Meaford, 16.VI.1983, ♀, S. Marshall (DEBU). **Welland Co.:** Ridgeway, 14.VI.1908, M, M. VanDayk (CAS). **Norfolk Co.:** Wilson Truct, 17.VI.1993, ♀, J. Skevington (DEBU).

Reviewed materials from other regions. 5♀ and 3♂ from NY, MD, GA, VA, and TX (CASC). Figure 6.

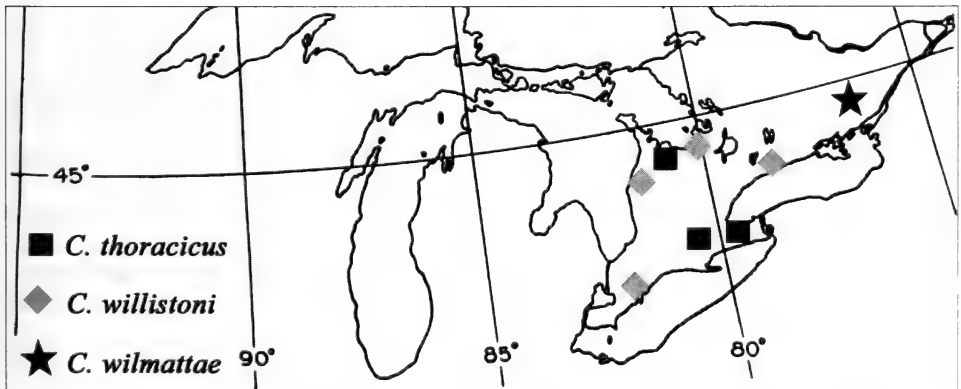


FIGURE 6. Ontario collection localities of *Colletes*: *C. thoracicus*, *C. willistoni*, *C. wilmattae*.

14. *C. validus* Cresson.

Cochrane Distr.: Timmins, 21.IV.1987, ♂, B. Westhaver (DEBU). **Sudbury Distr.:** Chapleau, Racine Lake, 30.V.1990, ♀, 14♂; 23.V.1991, 5♀; 3.VI.1992, ♀, 2m; 6.VI.1992, ♂, US, *Lowbush blueberry* (DEBU). **Haliburton Co.:** Algonquin Park, 31.V.1961, ♂, L. Pilfrey (DEBU). Figure 4.

Reviewed materials from other regions. F, M, MI (ROME).

15. *C. willistoni* Robertson.

Durham Co.: Kendal, 12.VII.1961, ♂, KN (ROME). **Simcoe Co.:** Midland, 23.VI.1974, ♂, J. Huber (DEBU); Awenda Provincial Park, Dune Trail, 22.VII.2002, ♀, S. Marshall (DEBU). **Bruce Co.:** Hepworth, 15.VII.1974, 2♂, PG (DEBU). **Kent Co.:** Rondeau Provincial Park, 28.VI.2002, 2♀, BK (DEBU). Figure 6.

16. **C. wilmattae* Cockerell.

Lanark Co.: Perth, 1.VIII.1961, ♀, KN (ROME). Figure 6.

Reviewed materials from other regions. Holotype, NM, Pecon, 9.VIII, ♀ (CASC). 2♀ and ♂, ND and NE (UCRC). Figure 6.

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References

- Hurd, P. D. 1979. Superfamily Apoidea, pp. 1741-2209 in K.V. Krombein, P.D. Hurd, Jr., D. R. Smith, and B. D. Burks, eds., Catalog of Hymenoptera in America North of Mexico. Vol.2. Washington: Smithsonian Institution Press. 2209 pp.
- MacKay, P.A. and G. Knerer. 1979. Seasonal occurrence and abundance in a community of wild bees from an old field habitat in Southern Ontario. Canadian Entomologist. 3:367-376.
- Michener, C.D. 2000. The Bees of the World. Baltimore & London: Johns Hopkins University Press. 913 pp.
- Mitchell, T. B. 1960. Bees of the eastern United States, 1. North Carolina Agricultural Experiment Station Technical Bulletin no.141. 538 pp.
- Mitchell, T. B. 1962. Bees of the eastern United States, 2: 1-557. North Carolina Agricultural Experiment Station Technical Bulletin no.152. 537 pp.
- Stephen W. P. 1954. A revision of the genus *Colletes* in America North of Mexico (Hymenoptera, Colletidae). University of Kansas Science Bulletin 36: 149-527.

**CABBAGE SEEDPOD WEEVIL, *CEUTORHYNCHUS OBSTRACTUS* (MARSHAM)
(COLEOPTERA: CURCULIONIDAE) IN ONTARIO
AND QUEBEC**

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Abstract

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The cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Marsham) [Coleoptera: Curculionidae] (CSW), is the most significant insect pest of canola in Europe and the US. Since its accidental introduction into Vancouver, Canada in 1931, CSW has been reported in the western and southeastern US (mid 1940s and early 1990s, respectively) but only recently has it invaded canola-growing regions in Alberta (1995), British Columbia (1997), Saskatchewan (2000) and Quebec (2000). In Ontario, CSW was found on Brassicaceae, including canola, *Brassica napus* L., and wild mustard, *Sinapis arvensis* L. at 28 and 38% of sites sampled in 2001 and 2002, respectively. In Quebec, CSW was found on three Brassicaceae, including canola, wild mustard, and wild radish, *Raphanus raphanistrum* L. at 66 and 78% of sites sampled in 2001 and 2002, respectively. In 2002, mean numbers of adult CSW collected on canola during flowering were 0.36 per 10 sweeps in Ontario, about 1/20 the number collected in Quebec (6.37 per 10 sweeps). At the pod stage, fewer canola fields were infested in Ontario (44%) than Quebec (72%). In canola fields where CSW occurred, up to 28% of pods were infested in Ontario compared to up to 58% in Quebec, resulting in economic loss in at least two and six fields surveyed, respectively. Numbers of seeds damaged per pod was 4 to 7 in Ontario and 1 to 7 in Quebec, typical for CSW. Although population numbers were lower and damage less in Ontario than in Quebec, CSW is clearly established in both provinces and there is potential for significant damage to the canola industry. Alternate host plants such as wild mustard and wild radish serve as reservoirs for CSW populations and will facilitate further dispersal and population increases.

Introduction

The cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Marsham) (Coleoptera: Curculionidae) [CSW] is the most significant insect pest causing yield loss of canola and oilseed rape, *Brassica napus* L. and *B. rapa* L. (Brassicaceae), in the US and Europe (Kuhlmann et al. 2002). Although first reported in the Vancouver area in 1931, CSW has only recently been reported in canola-growing areas of southern Alberta (1995), the interior of British Columbia (1997), Saskatchewan (2000) and southern Quebec (2000) (Philip 2000; Brodeur et al. 2001; Cárcamo et al. 2001; Dosdall et al. 2002). Since its introduction into North America, CSW has dispersed south and east, being reported in the Okanagan and Creston Valleys in British Columbia, the US Pacific Northwest (Washington, Idaho, Oregon) (mid 1940s), California, the southeastern US (Tennessee and Georgia) (early 1990s) (Cárcamo et al. 2001). Damage is caused primarily by larvae feeding on the seeds developing within the pods. About 20-30% of the seeds in a pod can be damaged (Kirk 1992, Cárcamo et al. 2001), and seed weight can be reduced by more than 16% (Buntin et al. 1995; Buntin 1999).

In Ontario, 24,282 ha of canola were planted in 2002 yielding 44,200 tonnes of seed (Canola Council of Canada 2004). Although this represents only approximately 1.1% of Canadian seed production, Ontario is an important area for variety testing and seed production for the industry in western Canada where the majority of canola is grown. Therefore, damage to crops in eastern Canada could have significant impact on the western Canadian canola industry. Further, although Brodeur et al. (2001) concluded that CSW was well established in Quebec, their study was restricted to spring-canola fields in the Quebec City area. Thus, surveys were conducted in southern Ontario and Quebec to determine distribution and abundance of CSW and levels of damage to canola.

Methods

To determine CSW distribution, surveys were conducted in 2001 and 2002 in areas where canola was known to be grown and at random sites where flowering Brassicaceae were observed. In Ontario, agricultural fields containing flowering Brassicaceae, including canola, *Brassica napus* L., mustard, *Sinapis alba* L., other crops infested with flowering wild mustard, *S. arvensis* L., and roadside patches of flowering wild mustard were sampled using a sweep net. In July 2001 and 2002, respectively, a total of 14 and 15 canola fields, and 15 and 18 wild mustard stands were sampled. A single mustard field was sampled in 2002. In Quebec, similar surveys were conducted in canola, wild mustard and wild radish, *Raphanus raphanistrum* L. (Brassicaceae). In July 2001 and 2002, respectively, a total of 10 and 3 canola fields, 12 and 13 wild mustard stands and 12 and 8 wild radish stands were sampled. A single stand of volunteer canola was sampled in 2002. In all commercial fields (canola and mustard), and where large patches of wild mustard and wild radish occurred, 100 standard 180° arc sweeps were taken while walking in a straight line; in smaller stands of wild mustard and wild radish as many sweeps as possible (minimum 12) were made. In commercial canola and mustard fields, sweeps were made while walking into the field along one transect beginning at a randomly selected point at the field edge. For volunteer canola, wild mustard and wild radish, sweeps were made where these plants occurred along field margins, roadsides or patches in fields. Sweep samples were placed in a white pan and adult weevils aspirated into vials for identification and processing.

In 2002, to assess abundance and damage additional surveys were done in August in canola fields in the pod stage, north and west of Guelph (Ontario) and south of Quebec City (Quebec). The latter surveys included a 100-sweep sample and collection of 50-pod samples to assess adult densities and seed damage, respectively.

In the laboratory, adult weevils were mounted on points and identified. The identity of CSW was confirmed by Dr. D.E. Bright of the Canadian National Collection of Insects, Arachnids and Nematodes, Agriculture and Agri-Food Canada. For each sample site, total numbers of CSW adults collected were recorded. The 50-pod samples were dissected and numbers of feeding holes, emergence holes, CSW larvae, seeds damaged, and total seeds were recorded.

Results and Discussion

CSW occurred at many but not all of the sites sampled (Figure 1) In Ontario, CSW was found at 8 of 28 (28.6%) of sites sampled in 2001 and 25 of 66 (37.9%) of sites sampled in 2002. Populations were most abundant in the canola growing areas north of Guelph. Although present at some locations, CSW was uncommon at sites from Pickering east to the Ontario/Quebec border. Brassicaceae host plants, particularly *Brassica* spp., *Raphanus* spp. and wild mustard in which larvae develop (Doucette 1947), were not abundant in these areas, which may be a barrier to establishment of CSW. However, canola fields and large stands of wild mustard occur in the eastern Ontario (Trenton - Ottawa - Ontario/Quebec border) area and CSW was not found at any of 12 sites sampled. In Quebec, CSW was found at 21 of 32 (65.6%) of sites sampled in 2001 and 32 of 41 (78.0%) of sites sampled in 2002. Populations were present and very abundant at all but two locations sampled in the canola growing areas south of Quebec City, but scattered and less numerous to the west.

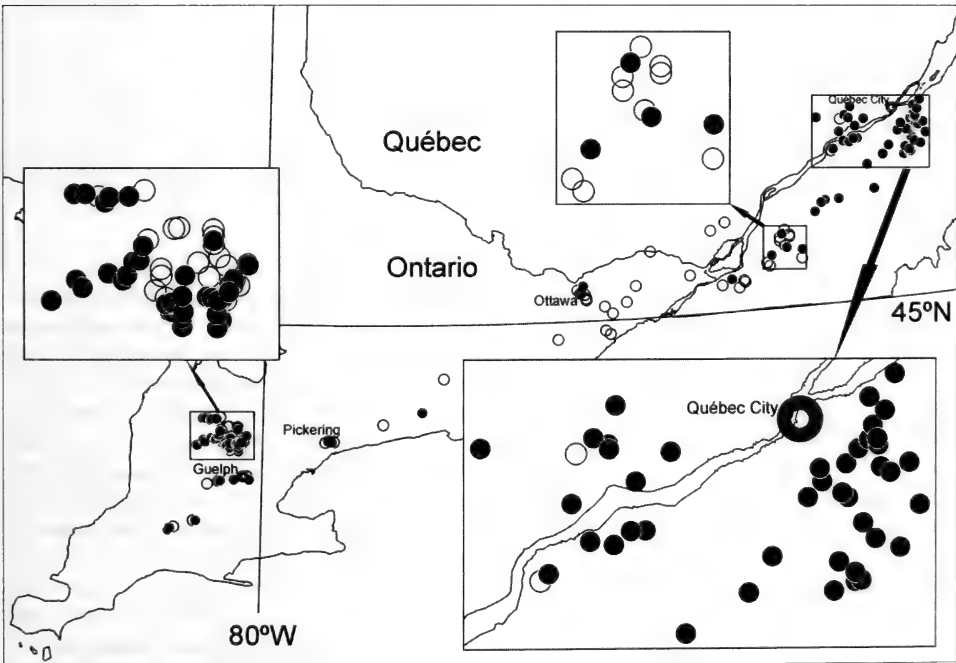


FIGURE 1. *Ceutorhynchus obstrictus* (Coleoptera: Curculionidae) distribution in southern Ontario and southwestern Quebec: locations where CSW was present (•) and locations sampled but where CSW was not present (o).

CSW adults were collected from all plant species surveyed in July of both years (Table I). Wild radish, although present in scattered locations in southern and eastern areas (Alex 1998), was not encountered during our surveys in Ontario. Mean numbers of adult CSW were approximately 20 times greater in southern Quebec compared to Ontario. According to Doucett (1947) CSW does not develop on commercial mustard, *S. alba*, in Washington state. This may explain the low numbers of adult CSW collected (0.05/10 sweeps) in mustard in Ontario despite being in close proximity to a canola field where 2.1 weevils/10 sweeps were collected. The abundance of CSW on wild mustard and wild radish indicates that management strategies that include crop rotations when canola is not planted may have little effect on reducing CSW populations. Further, spread of CSW in Ontario will be facilitated by presence of these preferred non-crop hosts.

TABLE I. Mean numbers of adult cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Coleoptera: Curculionidae), collected on host plants in the family Brassicaceae in Ontario and Quebec in July 2002.

Host Plant	Adult <i>C. obstrictus</i> (per 10 sweeps) \pm SE (n)	
	Ontario	Quebec
canola, <i>Brassica napus</i> L.	0.36 \pm 0.14 (15)	6.37 \pm 4.67 (3)
volunteer canola, <i>B. napus</i>	—*	5.43 \pm 4.18 (2)
mustard, <i>Sinapis alba</i> L.	0.05 (1)	—
wild mustard, <i>S. arvensis</i> L.	0.27 \pm 0.23 (18)	4.50 \pm 3.37 (11)
wild radish, <i>Raphanus raphanistrum</i> L.	—	6.56 \pm 5.86 (6)
mixed stands of wild mustard and wild radish	—	1.50 \pm 0.50 (2)

* no samples

Fewer canola fields were infested in Ontario (43.8%, n=32) than in southern Quebec (72.2%, n=18). Percent of pods infested by CSW varied considerably between fields in both regions (Tables II & III). In Ontario, where CSW occurred, up to 28% of pods (n =50) were infested whereas in southern Quebec up to 58% of pods (n =50) were infested (5 of 14 fields had more than 30% of pods infested). Brodeur et al. (2001) reported that percent pods infested ranged from 5.0 to 75.9% in four fields south of Quebec City in 2000. In our surveys, the wide variation in percent pods infested suggests that CSW infestations are not uniformly distributed, thus monitoring may be required on an individual field rather than an area-wide scale. Mean numbers of damaged seeds per infested pod were similar in both regions, ranging from 4.0 to 6.9 in Ontario and from 1.2 to 7.0 in southern Quebec. Brodeur et al. (2001) sampled 4 fields in southern Quebec and found that the mean number of seeds damaged per infested pod ranged from 5.2 to 9.2. Other studies have shown that larvae will consume 4-6 seeds during development (McCaffrey et al. 1986; Homan and McCaffrey 1993). Depending on insecticide costs and commodity price, yield losses occur when more than 26 to 40% of pods are infested (Buntin 1999). In our study, the number of damaged seeds ranged from about 6 to 41% and 15 to 34% of the total seeds per pod in Ontario and Quebec, respectively (Tables II & III). Thus, economic losses likely occurred in 2002 in at least two fields surveyed in Ontario and six in southern Quebec.

Pod sampling was done relatively late in the season (7-8 August in Ontario and 14-15 August in Quebec. Due to the wet spring there was a wide range of planting dates and a range of plant

TABLE II. Extent of damage and mean numbers of adult cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Coleoptera: Curculionidae), in commercial canola, *Brassica napus* (Brassicaceae), crops in southern Ontario during August 2002.

Location	Infested Pods (%)	n	# damaged seeds ±SE	%# damaged seeds ±SE	<i>C. obstrictus</i> adults / 10 sweeps
Kinburn (44°05.287'N 80°48.004'W)	12	6	4.7 ±0.4	19.9 ±1.5	12.4
Yeoville (44°04.519'N 80°42.503'W)	28	14	3.6 ±0.4	15.7 ±1.5	16.6
Maple Lane (44°05.131'N 80°37.268'W)	6	3	5.7 ±1.7	40.9 ±12.0	13.1
Conn 1 (43°59.160'N 80°33.973'W)	4	1	6	27.3	0
Conn 2 (40°58.888'N 80°34.165'W)	10	5	5.4 ±0.5	28.4 ±3.5	NA*
Kenilworth (43°54.332'N 80°37.268'W)	6	2	1.5 ±1.5	6.3 ±6.3	0.2
Farewell (43°54.866'N 80°41.306'W)	4	2	5.5 ±0.5	19.3 ±0.7	6.4
Glenlee 1 (43°52.849'N 80°46.483'W)	28	13	5.1 ±0.6	34.3 ±6.7	18.6
Glenlee 2 (43°52.880'N 80°46.755'W)	6	3	1.3 ±1.3	8.9 ±8.9	20.7
Palmerston (43°50.987'N 80°52.516'W)	2	1	7	25	6.1
Arthur (43°50.004'N 80°28.341'W)	12	4	5.0 ±1.8	25.2 ±10.2	4.3
Metz (43°49.391'N 80°26.250'W)	2	1	3	25	1.8
Luther March (43°54.906'N 80°21.564'W)	10	5	1.2 ±0.2	5.7 ±0.9	0

* data not available, adults collected but not counted

stages encountered during sampling, sometimes even in one field. In Ontario, plant stages from the end of flowering, when seeds are enlarging in the lower pods (stage 4.4 of Harper and Berenkamp [1975]), to the end of ripening when seeds in all pods are brown and the plants are senescent (stages 5.5) were encountered, with stage 5.2 (green seeds in the lower pods) being the most common. In southern Quebec, only ripening plants (stages 5.1-5.5) were found, with stage 5.2 also being the most common. Incidence of CSW larvae was low. Exit holes made by mature larvae provided an additional measure of infestation. No more than a single larva occurred in pods where larvae were found, contrasting with Brodeur et al. (2001), who found up to 3 larvae per pod. Adult CSW were collected at most fields, 20 of 31 (64.5%) in Ontario and 18 of 19 (94.7%) in southern Quebec. Adults were found in some fields in which pods were not infested. Because adults were common (up to 20.7 and 27.5 per 10 sweeps in Ontario and southern Quebec, respectively), we suspect that the new overwintering generation was emerging and dispersing.

In Ontario, CSW has established, although perhaps more recently than in southern Quebec, and some economic losses may have occurred in 2002. The source of these populations is not known and further studies may clarify this. Damage in infested fields is typical to that in other areas where CSW is established. The presence of alternate host plants, such as wild mustard and wild radish, provide reservoirs in which CSW populations can maintain and increase their numbers and facilitate further dispersal.

TABLE III. Extent of damage and mean numbers of adult cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Coleoptera: Curculionidae), in commercial canola, *Brassica napus* (Brassicaceae), crops in southern Quebec during August 2002.

Location	Infested Pods (%)	n	# damaged seeds ±SE	%# damaged seeds ±SE	<i>C. obstrictus</i> adults / 10 sweeps
Ste-Marie (46°26.982'N 71°06.126'W)	34	17	6.9 ±0.9	34.47 ±5.8	2.1
St-Raymond (46°52.898'N 71°50.269'W)	10	5	5.8 ±0.8	33.45 ±4.4	2.8
St-Charles de Bellechasse 1 (46°49.893'N 70°56.116'W)	20	9	5.1 ±0.7	20.69 ±3.1	0.8
Honfleur (46°39.974'N 70°55.381'W)	34	17	5.6 ±0.5	28.71 ±2.7	3.2
Bèlval (46°33.207'N 70°48.945'W)	4	1	4	15.4	21.7
Ste-Hénédine (46°31.785'N 71°00.603'W)	24	9	4.3 ±0.7	17.8 ±3.2	0.4
Quatre Chemin (46°35.108'N 71°03.914'W)	58	23	6.8 ±0.7	22.8 ±2.4	7.6
St-Elzéar (46°23.155'N 71°02.320'W)	6	2	4.0 ±1.0	22.2 ±9.1	17.5
Leclercville (46°33.643'N 71°58.645'W)	14	5	4.2 ±1.2	16.6 ±3.9	0.1
St-Charles de Bellechasse 2 (46°43.950'N 70°57.077'W)	8	2	3.5 ±2.5	14.8 ±3.7	0.6
St-Charles de Bellechasse 3 (46°45.165'N 70°56.435'W)	28	11	4.3 ±0.3	22.6 ±2.8	1
St-Charles de Bellechasse 4 (46°47.739'N 70°53.922'W)	10	4	4.3 ±1.0	21.4 ±1.6	9
St-Charles de Bellechasse 5 (46°42.658'N 70°55.826'W)	52	23	4.4 ±0.3	29.3 ±3.2	27.5
St-Charles de Bellechasse 6 (46°43.942'N 70°55.381'W)	42	19	5.4 ±0.7	28.9 ±3.8	16.2

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References

- Alex, J.F. 1998. Ontario Weeds. Ontario Ministry of Agriculture, Food and Rural Affairs Publication No. 505: 88.
- Brodeur, J., L. Leclerc, M. Fournier, and M. Roy. 2001. Cabbage seedpod weevil (Coleoptera: Curculionidae): new pest of canola in northeastern North America. *The Canadian Entomologist*, 133: 709-711.
- Buntin, G.D. 1999. Damage loss assessment and control of the cabbage seedpod weevil (Coleoptera: Curculionidae) in winter canola using insecticides. *Journal of Economic Entomology*, 92: 220-227.
- Buntin, G.D., J.P. McCaffrey, P.L. Raymer, and J. Romero. 1995. Quality and germination of rapeseed and canola seed damaged by adult cabbage seedpod weevil, *Ceutorhynchus assimilis* (Paykull) [Coleoptera: Curculionidae]. *Canadian Journal of Plant Science*, 75: 539-541.
- Canola Council of Canada. 2004. <http://www.canola-council.org/markets/acreage-productionandyield.html>. February 23, 2004.
- Cárcamo, H.A., L. Dosdall, M. Dolinski, O. Olfert, and J.R. Byers. 2001. The cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Coleoptera: Curculionidae) - a review. *Journal of the Entomological Society of British Columbia*, 98: 201-210.
- Dosdall, L.M., R.M. Weiss, O. Olfert, and H.A. Cárcamo. 2002. Temporal and geographical distribution patterns of cabbage seedpod weevil (Coleoptera: Curculionidae) in canola. *The Canadian Entomologist*, 134: 403-418.
- Doucette, C.F. 1947. Host plants of the cabbage seedpod weevil. *Journal of Economic Entomology*, 40: 838-840.
- Harper, F.R. and B. Berenkamp. 1975. Revised growth-stage key for *Brassica campestris* and *B. napus*. *Canadian Journal of Plant Science*, 55: 657-658.
- Homan, H.W. and J.P. McCaffrey. 1993. Insect pests of spring-planted canola. University of Idaho, Cooperative Extension System Publication No. 982: 2.
- Kirk, W.D.J. 1992. Insects on Cabbages and Oilseed Rape. *Naturalists' Handbooks* 18, Richmond Publishing Co. Ltd., Slough, England, 66 pp.
- Kuhlmann, U., L.M. Dosdall and P.G. Mason. 2002. *Ceutorhynchus obstrictus* (Marsham), Cabbage Seedpod Weevil (Coleoptera: Curculionidae). pp. 52-58 In P.G. Mason and J.T. Huber (eds.) *Biological Control Programmes in Canada 1981-2000*. CABI Publishers, Wallingford, UK, 583 pp.
- McCaffrey, J.P., L.E. O'Keeffe, and H.W. Homan. 1986. Cabbage seedpod weevil control in winter rapeseed. University of Idaho, Cooperative Extension Service, Current Information Series No. 782: 1-7.
- Philip, H. 2000. Minutes of the 40th Annual Meeting of the Western Committee on Crop Pests. October 16th, 2000. Moose Jaw, Saskatchewan, p. 5.

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations

$$\frac{dx}{dt} = f(x, y, z), \quad \frac{dy}{dt} = g(x, y, z), \quad \frac{dz}{dt} = h(x, y, z),$$

where f, g, h are continuous functions of x, y, z and satisfy the conditions

$$f(x, y, z) = O(\rho), \quad g(x, y, z) = O(\rho), \quad h(x, y, z) = O(\rho)$$

as $\rho \rightarrow 0$, where $\rho = \sqrt{x^2 + y^2 + z^2}$.

It is shown that the system has a solution

$$x = x(t), \quad y = y(t), \quad z = z(t)$$

which satisfies the initial conditions

$$x(0) = x_0, \quad y(0) = y_0, \quad z(0) = z_0$$

if and only if the functions f, g, h satisfy the conditions

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NEW RECORDS OF HEMIPTERA FROM CANADA AND ONTARIO

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Biodiversity, Research Branch, Agriculture and Agri-Food Canada,
Ottawa, Ontario, Canada, K1A 0C6.**Abstract***J. ent. Soc. Ont.* 134: 115-129

The following Hemiptera species are recorded from Canada for the first time, in many cases also representing new records at the generic level: *Neuroctenus simplex* (Uhler) (Aradidae); *Chariesterus antennator* (Fabricius) (Coreidae); *Hoplistoscelis sordidus* Reuter, *Metatropiphorus belfragei* Reuter (Nabidae); *Amaurochroa ovalis* Barber & Sailer, *Banasa euchlora* Stål, *Dendrocoris humeralis* (Uhler) (Pentatomidae); *Pnirontis modesta* Banks (Reduviidae); *Neokolla lugubris* (Signoret), *Polyamia herbida* DeLong, *Scaphoideus frisoni* DeLong & Mohr (Cicadellidae); *Delphacodes waldeni* Metcalf, *Megamelus davisii* Crawford, *Pentagramma douglasensis* Penner, *Stenocranus delicatus* Beamer (Delphacidae); *Anotia westwoodi* Fitch, *Cedusa kedusa* McAtee, *Otiocerus abbotti* Kirby, *O. amyotii* Fitch, *Otiocerus balli* McAtee, *Syntames uhleri* (Ball) (Derbidae); *Anormenis septentrionalis* (Spinola), *Ormenoides venusta* (Melichar) (Flatidae); *Thionia elliptica* Germar (Issidae); *Acutalis inornata* Ball, *Microcentrus perditus* (Amyot & Serville), *Publilia reticulata* Van Duzee, *Telamona fitchi* Ball, *T. gibberata* Ball (Membracidae); *Neolecanium cornuparvum* (Thro) (Coccidae); *Pseudococcus longispinus* (Targioni & Tozzetti) (Pseudococcidae); *Pachypsylla celtidisinteneris* Mally (Psyllidae); The following Hemiptera species are recorded from Ontario for the first time: *Pangaesus bilineatus* (Say) (Cydnidae); *Anaptus major* (Costa) (Nabidae); *Rhynocoris ventralis* (Say) (Reduviidae); *Eremocoris setosus* Blatchley (Rhyparochromidae); *Cuerna fenestella* Hamilton (Cicadellidae); *Megamelus metzaria* Crawford (Delphacidae); *Scolops pungens* Germar (Fulgoridae). Although Hemiptera were surveyed in several different parts of Ontario, most of the new records were found in a few small Carolinian sites.

Introduction

Insect survey work in southern Ontario routinely yields a high proportion of taxa newly recorded from Canada or Ontario because, for most groups of insects, there are no recent checklists, there has been no recent taxonomic work on the taxa in question, and regional collections have not been recently reviewed for new distributional data. The recent publication of a comprehensive checklist of the Hemiptera of Canada and Alaska (Maw et al. 2000) provides an exception to these generalizations, and gives us a current benchmark against which to evaluate the new records appearing in our recent southern Ontario insect surveys. The following list of 39 new records are organized according to the family and generic combinations used in Maw et al. (2000), but does not follow their subordinal classification. Maw et al. (2000) divide the Canadian Hemiptera into

four suborders (Prosorrhyncha, Archaeorrhyncha, Clypeorrhyncha, Sternorrhyncha) as proposed by Sorenson et al. (1995). We feel that Sorenson et al. do not make a strong case for a new subordinal classification, and will therefore follow the more traditional breakdown of the Hemiptera into the Heteroptera, Auchenorrhyncha (Cicadoidea plus Fulgoroidea), and Sternorrhyncha.

Over the past decade, personnel associated with the University of Guelph Insect Collection have been involved with surveying several Carolinian sites throughout southwestern Ontario. A special focus has been placed on documenting the fauna of several tallgrass prairie (Fig. 1; 6, 10, 12, 14, 21) and oak savannah (Fig. 1; 6, 10, 12, 14, 20, 21, 23, 25) sites. These small sites cover very little area in Ontario and Canada, but contain a large proportion of Ontario's rare and habitat-restricted flora and fauna. Most of the new provincial and national records we report here are from a few key protected Carolinian areas in Ontario. We record eight Heteroptera, twenty-one Auchenorrhyncha and three Sternorrhyncha species new to Canada, along with four Heteroptera and three Auchenorrhyncha new to Ontario.

Materials and Methods

Heteroptera were identified using Slater and Baranowski (1978) and McPherson (1982), further supplemented with Larivière (1992) and Barber (1929). Auchenorrhyncha were identified using references cited in Maw et al. (2000) and supplemental references are cited here.

Specimens are deposited at the University of Guelph Insect Collection (default) and the Canadian National Collection (CNCI). Figure 1 shows all sites mentioned in this paper.

Results

1) Suborder Heteroptera

The Heteroptera comprise a relatively small suborder of more frequently collected, easily identifiable insects. The recent checklist by Maw et al. (2000) reflects distributional information gathered from all major Canadian insect collections. Heteroptera records added since 2000 are therefore either newly introduced or newly established species or species previously overlooked because of rarity or restriction to unusual or poorly known habitats. The results of recent surveys support the assumption that Ontario Heteroptera are well known. For example, a collection of about 2600 insect species, including 115 species of Heteroptera, from the Bruce Peninsula includes a number of rarely collected species, but only one species new to Ontario. Smaller collections from ongoing survey projects in Carolinian reserves, however, include the following Heteroptera newly recorded from Canada or Ontario. Only one of these species was introduced to North America, while the other species appear to be rare or associated with restricted habitats in Canada.

Aradidae

Neuroctenus simplex (Uhler)

Although Slater and Baranowski (1978) state that this small, black aradid is common in the northeastern USA, neither the genus nor the species have previously been recorded from Canada. This species differs from other Canadian species by the closed atrium, which covers the basal portion of the labium. Slater and Baranowski (1973) record it from beech (*Fagus*) and oak (*Quercus*).

Specimen Data: **Niagara Reg.**, 1 ♀, Vineland, 19 July 1940, W.L. Putman; **Haldimand-Norfolk Reg.**, 1 ♀, Simcoe, 23 June 1953, (collector not indicated); **Lambton Co.**, 1 ♀, Port Franks, Karner Blue Sanctuary, 13 June 1996, J. Skevington; **Essex Co.**, 1 ♀, Ojibway Prairie Prov. Nat. Res., 12 September 2002, S.M. Paiero.

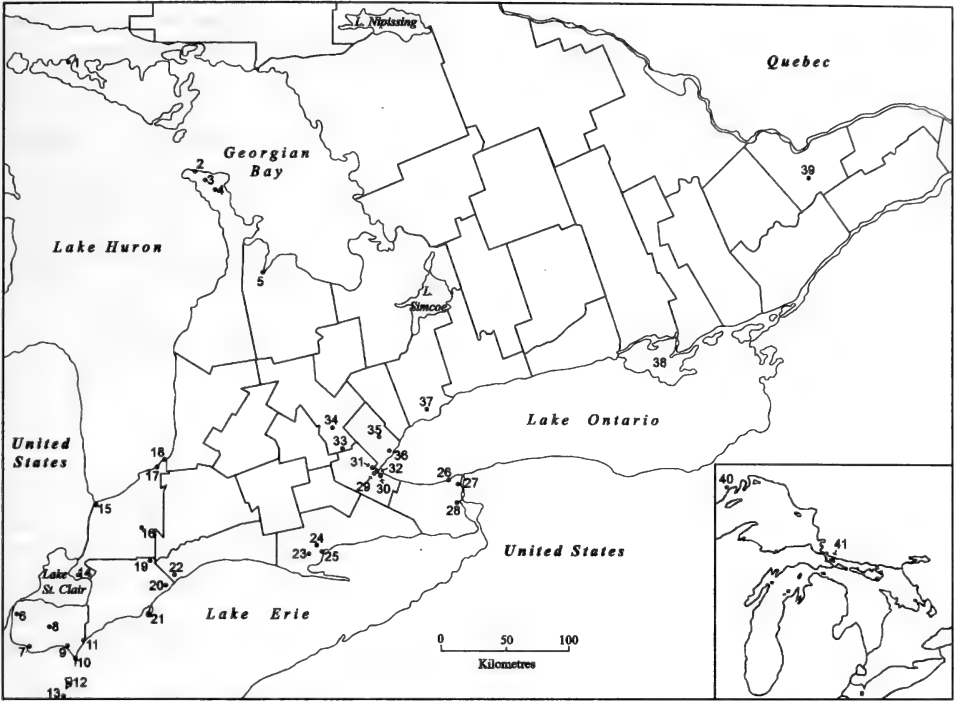


FIGURE 1. Southern Ontario localities with new Hemiptera. 1, 14km E Meldrum Bay; 2, Dunks Bay; 3, 8 km SE of Tobermory; 4, Alvar nr. Dyers Bay Rd. & Hwy #6; 5, Owen Sound; 6, Windsor, Ojibway Prairie Provincial Nature Reserve; 7, Harrow; 8, Woodslee; 9, Leamington; 10, Point Pelee National Park; 11, Wheatley; 12, Pelee Island; 13, Middle Island; 14, Walpole Island; 15, Sarnia; 16, Wyoming; 17, Port Franks; 18, Grand Bend; 19, Bothwell; 20, Clear Creek Reserve; 21, Rondeau Provincial Park; 22, Rodney; 23, Manestar Tract, 6 km NNW St. Williams; 24, Simcoe; 25, Turkey Point Provincial Park; 26, Vineland; 27, Niagara Glen; 28, St. Davids; 29, Dundas; 30, Hamilton; 31, Borers Falls; 32, Royal Botanical Gardens; 33, Crieff; 34, Guelph; 35, Milton; 36, Oakville; 37, Toronto; 38, Prince Edward Co. (locality not indicated); 39, Richmond, 8 km S. Insert: 40, Thunder Bay; 41, Hilton Beach. Modified from: Brock University Map Library. Southern Ontario-Regional Municipality Boundaries. [pdf]. Software Edition. St.Catharines, ON: Brock University Map Library. 2004. [sontbase.pdf]

Coreidae

Chariesterus antennator (Fabricius)

The genus and species is recorded from Canada for the first time. This leaf-footed bug, easily distinguished from other Canadian coreids by its dilated and flattened third antennomere, appears to be restricted to three sites of tallgrass habitat, or to have tallgrass prairie affinities in Ontario. *Chariesterus antennator* was first observed on 9 July 1992 and we have observed it commonly at both Ojibway Prairie Provincial Nature Reserve and the Manestar Nature Reserve since then. It is also present on Walpole Island. The conspicuous spiny nymphs appear from May to August, and adults have been collected from May to September, usually on *Euphorbia* although several specimens

were observed on a dead toad. Slater and Baranowski (1978) record *C. antennator* throughout the eastern and central USA but is "scarce and scattered north of the middle Atlantic states". We consider this species to be associated with of Ontario's tallgrass prairies.

Specimen Data: **Haldimand-Norfolk Reg.**, Manestar Tract, 6 km NNW St. Williams, 1 specimen (photo only), feeding on *Euphorbia*, 9 July 1992, S.A. Marshall; 1♂2♀♀, 30 June 2000, M. Buck; 1♂, yellow pans, 8 June 2001, M. Buck; 1♂2♀♀, sandy field, 15 June 2001, S.M. Paiero; 1♀, sandy field, white pans, 7 September 2001, Buck & Paiero; 2♀♀, sandy field, 7 September 2001, S.M. Paiero; 2♂♂, sandy field, yellow pans, 23 May 2002, Buck & Paiero; 1♂1♀, 15 June 2003, S.A. Marshall; **Lambton Co.**, 1 nymph, Walpole Island, 4 August 1996, J. & A. Skevington; **Essex Co.**, Windsor, Ojibway Prairie Provincial Nature Reserve, 1♀, 18 August 1980, K.N. Barber; 1 nymph, 21 July 2000, S.A. Marshall; 1 nymph, 20 July 2002, S.A. Marshall; 1♂, 8-9 July 2002, S.A. Marshall; 1♀, 30-31 July 2002, S.M. Paiero; 1♂, sweeps, 25 June 2001, S.M. Paiero.

Cydnidæ

Pangaeus bilineatus (Say)

This is Ontario's only *Pangaeus* and the largest (5-8 mm) burrower bug in Ontario. This species has been recorded from Quebec, but neither the genus nor the species was previously known from Ontario. Slater and Baranowski (1978) state that this is a rare species in the northern USA and that "old records from Quebec and New England need verification". Ontario records are from several Carolinian sites. It was first recorded from Point Pelee's east beach in September 1997 (photo only). McPherson (1982) records several host plants.

Specimen Data: **Essex Co.**, 1♂, Pelee Island, Porchuk property, malaise, 9-28 August 2002, Porchuk & Marshall; 1♀ Pelee Island, Lighthouse Point Prov. Nat. Res., 8 June 2002, M. Buck; 1♂, Pelee Island, Fish Point Prov. Nat. Res., 8 June 2002, S.A. Marshall; 1♀, Pelee Island, East Park campground, 7 June 2002, S.A. Marshall; 1 specimen (photo only), Point Pelee Ntnl. Pk., east beach, September 1997, S.A. Marshall; 1♀, Point Pelee Ntnl. Pk., Opuntia field, yellow pans, 24-25 July 2003, Cheung & Paiero; 1 nymph, Point Pelee Ntnl. Pk., wooded area by West beach, malaise/pan traps, 10-23 September 1999, O. Lonsdale; 1♀, Point Pelee Ntnl. Pk., De Laurier Trail, 14 August 2003, M. Buck; 1♀, Point Pelee Ntnl. Pk., The Dunes, 24 July 2003, S.M. Paiero; 1♂2♀♀, Point Pelee Ntnl. Pk., Opuntia field, 11-17 July 2003, D. Cheung; 1♀ Ruscom Shores Conservation Area, E of Deerbrook, 8 July 2002, S.A. Marshall; 1♀, Windsor, Ojibway Prairie Prov. Nat. Res., 8-9 July 2002, S.A. Marshall.

Nabidae

Anaptus major (Costa)

This species is recorded for the first time in Ontario. *Anaptus major* is an introduced Palearctic species that was first recorded in North America by Barber (1932). It has since been recorded from eastern North America in New York and Pennsylvania (Wheeler 1976) and has been recorded in Canada from British Columbia (Lattin 1966). This species can be distinguished from other nabids in eastern Canada by the characters given in Larivière (1992).

Specimen Data: **Grey Co.**, 1♀, Owen Sound, meadow, 17 September 1989, G.J. Suchomel; **Niagara Reg.**, 1♀, Vineland, 2 August 1958, C.A. Small; 1♀, Vineland, June 1956, H.W.H. Zavitz; **Halton Reg.**, 1♀, Oakville, 3 August 1977, W.A. Attwater; 1♀, Oakville, nr. Hwy #25 & Burnhamthorpe Rd., yellow pans, 12-14 September 2003, S.M. Paiero; **Hamilton-Wentworth Reg.**, 1♀, Borsers Falls, 14 August 1978, B. Watner; 1♀, **Elgin Co.**, Rodney, 29 August 1983,

M. Mezenberg; **Wellington Co.**, Guelph, University of Guelph Arboretum (south), 1 ♀, field sweep, 31 July 1997, D.C. Caloren; 1 ♀, field/rocky trail, 17 August 1997, D.C. Caloren; 1 ♀, Guelph, 15 July 1976, W.A. Attwater; 1 ♀, Guelph, flower, 25 September 1984, T. Young.

***Hoplistoscelis sordidus* Reuter**

This is the second *Hoplistoscelis* to be recorded from Canada, and the first record of the genus from eastern Canada. This nabid, commonly collected in its brachypterous form throughout the eastern USA, has probably been overlooked in Canada due to its resemblance to nymphal *Nabis*. *Hoplistoscelis* is readily distinguished from other nabids in eastern Canada by the denticulate fore and mid femora (Harris 1928). Blades and Marshall (1994) tentatively recorded this species from Ontario but further study of their material revealed that their specimens were species of *Nabis*.

Specimen Data: **Haldimand-Norfolk Reg.**, 1 ♀, Manestar Tract, 6km NNW St. Williams, forest, white pans, 15 June 2001, Buck, Paiero & McKendry; **Essex Co.**, Windsor, Ojibway Prairie Prov. Nat. Res., 1 ♀, yellow pans, 29 June-3 July 2001, S.M. Paiero; 1 ♀, 18-19 June 2002, O. Lonsdale; 1 ♂, 26-27 August 2002, S.M. Paiero; 1 ♀, Ojibway Prairie Prov. Nat. Res., nr. Sprucewood Ave. observation point, yellow pans, 12-13 September 2002, Buck & Paiero; **Lambton Co.**, Port Franks, Watson Property nr. L-Lake, 1 ♂ 17 September 1996, J. Skevington; 1 ♀, 15 June 1996, J. Skevington; 1 ♀, 20 June 1996, J. Skevington; **Kent Co.**, 1 ♀, Wheatley, 11 August 1973, R.E. Roughley; 1 ♀, Rondeau Prov. Pk., Harrison trail nr. Group campground, 17 June 2003, S.M. Paiero; 1 ♀, Rondeau Prov. Pk., Tulip Tree trail, Carolinian forest, sweeps, 7 September 2003, M. Buck; 1 ♂ 3 ♀ ♀, Clear Creek Res., 10 October 2003, Marshall & Paiero; **Wellington Co.**, 1 ♀, Guelph, grass, 10 October 1984, T. Young; 1 ♂, Guelph, University of Guelph w. campus grove, sweep net, 26 September 1990, M.M. Castillo; 1 ♀, Crieff, 2 km SE on 7th Conc., 30 August 2002, S.A. Marshall.

***Metatropiphorus belfragei* Reuter**

The genus is recorded for the first time in Canada. Whereas this species is apparently scarce throughout the eastern United States (Slater and Baranowski 1978), it has been recorded from several northeastern states (Harris 1928) and it is not surprising to find it in Canada. It can be distinguished from other Ontario nabids by the 1st antennomere being longer than the head and by the lack of tibial pads.

Specimen Data: **Halton Reg.**, 1 ♀, Oakville, nr. Hwy. #25 & Burnhamthorpe Rd., 9-10 August 2003, S.M. Paiero.

Pentatomidae

Most members of the Pentatomidae are relatively conspicuous and well-known insects, therefore the discovery of four pentatomids new to Canada shows how poorly known our Carolinian fauna was before this study. These species are best separated from other eastern Pentatomidae by the keys given in McPherson (1982).

***Amaurochroa ovalis* Barber & Sailer**

This species is recorded for the first time in Canada. One other species (*A. cinctipes* (Say)) was previously known from eastern Canada. *Amaurochroa* is generally associated with damp grassy areas or streamside vegetation (McPherson 1982) and the specimens collected from Pelee Island were found on an unidentified grass.

Specimen Data: **Essex Co.**, 1 ♀, Ojibway Prairie Prov. Nat. Res., yellow pans, 12-15 June 2001, S.M. Paiero; 7 ♂ 5 ♀ ♀, Pelee Island, Fish Point Prov. Nat. Res., Marshall & Paiero.

***Banasa euchlora* Stål**

This species is recorded for the first time in Canada. It is known to occur throughout the eastern US, where it feeds on cedar and juniper trees (McPherson 1982).

Specimen Data: **Essex Co.**, 1♂, Point Pelee Ntnl. Pk., 23 August 2000, O. Lonsdale; **Halton Reg.**, 1♂, Milton, Derry Rd. and 4th Line, at light, 23 August 2002, S.M. Paiero.

***Dendrocoris humeralis* (Uhler)**

This genus is recorded for the first time in Canada. *Dendrocoris humeralis* is found throughout the eastern USA and is known to feed on oak, hickory, pine, peach, brome grass, locust, elderberry, and raspberry (McPherson 1982).

Specimen Data: **Essex Co.**, 1♂, Windsor, ~1.5 km S Ojibway Prairie Prov. Nat. Res., prairie remnant-forest edge, malaise, 1-19 August 2001, P. Pratt; **Halton Reg.**, Oakville, nr. Hwy #25 & Burnhamthorpe Rd., 2♂♂, 30 August 2003, S.M. Paiero; 1♂, 12 September 2003, S.M. Paiero; 1♂, forest, malaise, 14 September-1 October 2003, S.M. Paiero; **Haldimand-Norfolk Reg.**, 1 nymph, Turkey Point Prov. Pk., prey of *Astata nubecula* Cresson (Crabronidae), 17 August 2003, M. Buck; **Lambton Co.**, 1♀, Port Franks, Karner Blue Sanctuary, malaise, 8-10 June 1996, J. Skevington.

Reduviidae***Pnirontis modesta* Banks**

The genus and species is recorded from Canada for the first time. This species was known previously in the east from Virginia south to Florida, west to Texas and north to Indiana (Barber 1929) and Illinois (Hagerty and McPherson 1999). This dull yellow assassin bug is distinguished from other reduviids in Ontario by the branched spines below the eye, a ventral row of spines on the first antennal segment, the blunt spine on the apex of the first antennal segment, and two rows of spines on the fore tibia.

Specimen Data: **Kent Co.**, 1♂, Rondeau Prov. Pk., Visitors Centre, mercury vapour light, 3 July 2003, S.M. Paiero.

***Rhynocoris ventralis* (Say)**

This genus is newly recorded for Ontario. It is a widely distributed species in the USA east of the Rocky Mountains, and is previously known in Canada from British Columbia east to Manitoba. *Rhynocoris ventralis* is the only black and red assassin bug in Ontario.

Specimen Data: **Haldimand-Norfolk Reg.**, Manestar Tract, 6km NNW St. Williams, sandy field, 1♀, 3 June 2000, M. Buck; 2♀♀, white pans, 25 July 2000, M. Buck; 1♀, white pans, 15 June 2001, M. Buck, Paiero & McKendry; 2♂♂2♀♀, yellow pans, 25 June 2001, M. Buck; 1♂, white pans, 25 June 2001, M. Buck; 1♂, 15 June 2001, S.M. Paiero; 1♂, white pans, 3 August 2001, M. Buck & Parchami-Araghi.

Rhyparochromidae***Eremocoris setosus* Blatchley**

This species was previously known from Quebec and is recorded in the USA from Ohio south to Florida (Slater and Baranowski 1990). No hosts are recorded. This species can be distinguished from other *Eremocoris* by the unicolourous dark brown colouration and the dense long setae of the body.

Specimen Data: **Bruce Co.**, 1♀, Alvar nr. Dyers Bay Rd. & Hwy #6, pan trap, 31 May-8 June 2000, C.S. Onodera.

2) Suborder Auchenorrhyncha (superfamilies Cicadoidea and Fulgoroidea)

Although a larger and less thoroughly documented group than the Heteroptera, the Auchenorrhyncha of Ontario have been extensively studied (e.g., Hamilton 1992; Bouchard et al. 2002), and the checklist in Maw et al. (2000) included virtually all of the species taken in recent collecting and survey work outside a few Carolinian sites. For example, of 2202 specimens and 147 species of Auchenorrhyncha recently collected as part of a survey of insects of the upper Bruce Peninsula, many species were previously known only from a few localities in Canada, however all but one were previously recorded from Canada. As was the case for the Heteroptera, the new records of Auchenorrhyncha have generally been discovered in small and environmentally sensitive patches of habitat in Carolinian Ontario.

Cicadellidae

Cuerna fenestella Hamilton

This distinctive species is newly recorded from Ontario and is abundant in a small portion of the Ojibway Prairie Provincial Nature Reserve. Like its common congener *C. striata* (Walker), which is well known and abundant in Ontario, *C. fenestella* overwinters as an adult and can be found in large numbers very early in the spring, although adults have been taken in every warm month of the year. *Cuerna fenestella* was not previously recorded east of Manitoba (Hamilton 1970). In Ontario, it is restricted to tallgrass prairie. The host plant is unknown.

Specimen Data: Essex Co., Windsor, Ojibway Prairie Prov. Nat. Res., 1 ♀, 26 June 1997, S.A. Marshall; 1 specimen, 12 September 1999, S.A. Marshall; 1 specimen, 29 April 2000, S.A. Marshall; 1 specimen, 27 May 2000, S.A. Marshall; 12 ♂♂ 16 ♀♀, 3 May-12 October 2001, yellow pan traps, Paiero et al.

Neokolla lugubris (Signoret)

This species is newly recorded from Canada. *Neokolla lugubris* is a senior synonym of *Keonolla dolobrata* (Ball), and also has been placed in *Graphocephala* (Young 1977) where it was erroneously treated as a synonym of *G. hieroglyphica* (Say). Hamilton and Langor (1987) discuss the problem of the identity of *Neokolla hieroglyphica* (Say).

Specimen Data: Essex Co., 1 ♂, Windsor, Ojibway Prairie Prov. Nat. Res., sweeps and yellow pans, 13-14 July 2001, S.M. Paiero.

Polyamia herbida DeLong

This species is newly recorded from Canada. *Polyamia herbida* is a prairie species previously known only from Illinois (Sinada and Blocker 1994).

Specimen Data: Bruce Co., 2 ♂♂ 2 ♀♀ (CNCI), 8 km SE of Tobermory, 17 August 1988, K.G.A. Hamilton.

Scaphoideus frisoni DeLong & Mohr

This species is newly recorded from Canada. Nothing is known about the biology of *S. frisoni* except that it, like most of its congeners, inhabits understory vegetation in woodlands.

Specimen Data: Bruce Co., 1 ♂, Dunks Bay, Adam's farm, malaise, 10-29 August 1997, S.A. Marshall; Essex Co., 1 ♂, Point Pelee Ntnl. Pk., malaise & pan trap, 26 July - 4 August 1999, A. Tesolin.

Delphacidae***Delphacodes waldeni* Metcalf**

This species is newly recorded from Canada. This species was previously known only from Connecticut (Metcalf 1923). Nothing is known about its host plants.

Specimen Data: Essex Co., 1♂, Windsor, Ojibway Prairie Prov. Nat. Res., unburnt woods, yellow pans, 30 August-4 September 2001, S.M. Paiero.

***Megamelus davisi* Van Duzee**

This species is newly recorded from Canada. It is known to feed on the leaves of water lilies (*Nuphar advena* (Aiton), Wilson and McPherson 1981a).

Specimen Data: Essex Co., 4♀♀, Point Pelee Ntnl. Pk., Marsh trail, 23 August 2000, O. Lonsdale.

***Megamelus metzaria* Crawford**

This species is newly recorded in Ontario. *Megamelus metzaria* had previously been known from Saskatchewan to Nova Scotia, with the exception of Ontario. It is known to feed on *Spartina* (Wilson et al. 1993).

Specimen Data: Essex Co., Ojibway Prairie Prov. Nat. Res., yellow pans, 1♀, 4-7 September 2001, S.M. Paiero; 1♂, 14-18 September 2001, S.M. Paiero; 2♂♂1♀, 2-5 October 2001, S.M. Paiero; **Thunder Bay Distr.**, 1♂(CNCI), Thunder Bay, Manitou Mounds, 19 July 2002, R. Foster.

***Pentagramma douglasensis* Penner**

This species is newly recorded from Canada. It was previously only known from Michigan (Penner 1947).

Specimen Data: Manitoulin Distr., 1♀ (CNCI), Manitoulin Island, 14 km E of Meldrum Bay, 19 August 1988, K.G.A. Hamilton.

***Stenocranus delicatus* Beamer**

This species is newly recorded from Canada. It is a prairie species previously known only from Kansas and Illinois (Beamer 1946).

Specimen Data: Manitoulin Distr., 1♂4♀♀(CNCI), Manitoulin Island, 14 km E of Meldrum Bay, 19 August 1988, K.G.A. Hamilton.

Derbidae***Anotia westwoodi* Fitch**

This species is newly recorded from Canada. This species feeds on various deciduous trees (Dozier 1926), and has previously been recorded from the northeastern USA (Wilson and McPherson 1980a).

Specimen Data: Essex Co., 1♂, Windsor, Ojibway Ojibway Prairie Prov. Nat. Res., nr. Sprucewood Ave. observation point, yellow pans, 28-29 August 2002, Buck & Paiero.

***Cedusa kedusa* McAtee**

This species is newly recorded from Canada. Although no host plants have been recorded, *C. kedusa* likely feeds on a variety of deciduous trees like its congeners (Dozier 1926) and is widely distributed throughout the eastern USA from New York to Florida (Wilson and McPherson 1980a).

Specimen Data: Lambton Co., 2♂♂ 13♀♀, Port Franks, Karner Blue Sanctuary, malaise, 27 June-30 July 1996, J. Skevington.

***Otiocerus abbotti* Kirby**

This species is newly recorded from Canada. It is known throughout the northeastern USA and south into Florida (Wilson and McPherson 1980a). Dozier (1926) records it on oak (*Quercus*).

Specimen Data: Kent Co., 1♂, Rondeau Prov. Pk., Spicebush trail, Carolinian forest, malaise, 15 August-7 September 2003, Marshall et al.

***Otiocerus amyotii* Fitch**

This species is newly recorded from Canada. It has been recorded as feeding on “hickory and other forest trees” (Dozier 1926) but probably feeds on a variety of deciduous trees. It is known throughout the northeastern USA and south into North Carolina (Wilson and McPherson 1980a).

Specimen Data: Hamilton-Wentworth Reg., Dundas, 4♀♀, 22-29 July 1980, E.A. Menard.

***Otiocerus balli* McAtee**

This species is newly recorded from Canada. This species likely feeds exclusively on deciduous trees (Dozier 1926) and has been recorded in the northeastern USA (as *Shellenius*, Wilson and McPherson 1980a).

Specimen Data: Algoma Distr., 1♂, Hilton Beach, hardwood forest/field malaise, 7 August 1987, F.W. & J.H. Swann; 1♀, Hilton Beach, forest/field malaise, 1-3 August 1987, F.W. & J.H. Swann.

***Syntames uhleri* (Ball)**

This genus and species, previously known from the northeastern USA, are recorded for the first time in Canada from a fen near the town of Richmond. Dozier (1926) recorded it from an ironweed leaf (*Vernonia* sp.) and from sweep netting samples taken in deciduous woods throughout the northeastern USA from New York south into Mississippi (as *Omolicna*, Wilson and McPherson 1980a).

Specimen Data: Carleton Co., 1♂ 1♀, Richmond, 8 km S, fen, sweeping, 22 August 2000, M. Buck.

Flatidae***Anormenis septentrionalis* (Spinola)**

This genus is newly recorded from Canada. This species is widespread in the eastern USA (Wilson and McPherson 1981b), and it is not surprising to find it in southern Ontario. Unlike some other fulgoroids, such as *Acanalonia conica* (Say), which have expanded their range northward over the past few decades (Pechuman and Wheeler 1981), *A. septentrionalis* has been part of our fauna for some time and specimens are known from as early as 1961 (two specimens, labelled “Windsor” but probably from Ojibway Prairie). This species is known to have a wide host plant range of more than 40 species (Wilson and McPherson 1980b).

Specimen Data: **Essex Co.**, 2♂♂, Windsor, 12 August 1961, G.P. Brumpton; 1♀, Windsor, 10 August 1977, C.A. Schisler; 1♂2♀♀, Windsor, ~1.5km S Ojibway Prairie Prov. Nat. Res., malaise, 22 September-13 October 2001, S.M. Paiero; 1♀, malaise, 1-22 September 2001, S.M. Paiero; 1♀, Harrow, grass/tree field, sweep net, 8 August 1997, P. Livingston; 1♂, Woodsley, 9 August 1976, J. Hearty; **Hamilton-Wentworth Reg.**, 1♀, Dundas, North Shore trails, 25 August 2002, S.A. Marshall; **Kent Co.**, 1♀, Clear Creek Res., 10 October 2003, S.M. Paiero; 1♀, Wyoming, flower, 26 August 2000, J. Smith; **Lambton Co.**, 1♂, Sarnia, Lambton College, 4 September 1996, J. Skevington.

Ormenoides venusta (Melichar)

This genus is newly recorded from Canada. It was previously known from the eastern USA south to Florida and Texas (Wilson and McPherson 1981b). Wilson and McPherson (1980b) record it from *Carya*, *Juglans*, *Ulmus*, *Pyrus*, and *Vitis*; we have observed it feeding on *Cornus*.

Specimen Data: **Essex Co.** Windsor, Ojibway Prairie Prov. Nat. Res., 1♀, 13 August 2002, S.A. Marshall; 5♂♂, 12-13 September 2002, S.M. Paiero; 9♂♂5♀♀, 26-27 September 2002, S.M. Paiero.

Fulgoridae

Scolops pungens Germar

This species is newly recorded from Ontario and was previously tentatively recorded from Saskatchewan and Manitoba (Maw et al. 2000). *Scolops* species are known to feed on a variety of grasses, and individuals are commonly collected by sweeping grasses in late summer. No specific hosts are recorded for this species.

Specimen Data: **Essex Co.**, 1♀, Harrow, overgrown lot, sweep net, 10 August 1987, P. Livingston; 1♂(NCI), Leamington, 15 August 1970, T.D. Galloway; **York Reg.**, 1♂, Toronto, 27 July 1981, L. Coote.

Issidae

Thionia elliptica Germar

This species is newly recorded from Canada. Little is known about the host plants of *T. elliptica*, although its sister species, *T. bullata*, is known to feed on oaks and hickory (Dozier 1926), and it is likely that *T. elliptica* feeds on a similar range of hosts. *Thionia bullata* is relatively rare in Ontario, having only been recorded from four females taken at different sites (Bothwell, 17 August 1974; Niagara Glen, 20 August 1998; St. Davids, 20 August 1934; Rondeau Provincial Park, 4 October 2001). Both species occur throughout the northeastern USA (Wilson and McPherson 1980a).

Specimen Data: **Hamilton-Wentworth Reg.**, 1♀, Hamilton, 21 June 1983, G.L. Livingston.

Membracidae

Acutalis inornata Ball

This species is newly recorded in Canada. This species was previously recorded from Missouri (Kopp and Yonke 1973a) and Florida (Van Duzee 1917). While some authors have regarded *A. inornata* to be a colour variety of *A. tartarea* (Say) (Kopp and Yonke 1973a; Tsai and Kopp 1980), we regard *A. inornata* as a distinct species from *A. tartarea* and *A. brunnea* (Provancher) as none of the specimens examined (12 *A. tartarea*, 97 *A. brunnea*) exhibited any tendencies towards the

paler form of *A. inornata*. The three species can be identified by the following characters: *A. tartarea* has a completely black pronotum with the forewing, except for the apical cells, black and opaque; *A. inornata* is completely pale with hyaline forewings; *A. brunnea* is marked with black on the pronotum with hyaline forewings. Although Kopp and Yonke (1973b) record several hosts for the *Acutalis tartarea*, no specific hosts are specifically mentioned for *A. inornata* as it was considered to be a colour variety of *A. tartarea*.

Specimen Data: Lambton Co., 1 ♀ (CNCI), Grand Bend, 11 July 1939, G.E. Shewell.

Microcentrus perditus (Amyot & Serville)

This species is newly recorded from Ontario and is distinctive from other Ontario membracids with its pair of flattened pronotal horns, visible scutellum and bark-like appearance. The recorded host plants are scrub oak and bur oak (Kopp and Yonke 1973b; Hamilton 1985). The second species of *Microcentrus*, *M. caryae* (Fitch) feeds on hickory (*Carya sp.*) and is known in Canada from Ontario and Quebec (Maw et al. 2000). Both species occur in the northeastern USA (Kopp and Yonke 1973b; Hamilton 1985) but are uncommonly collected.

Specimen Data: Haldimand-Norfolk Reg., 1 ♀, Manestar Tract, 6 km NNW St. Williams, on Crategus, 15 June 2001, S.M. Paiero.

Publilia reticulata Van Duzee

This species is newly recorded from Canada. Kopp and Yonke (1973b) record this species from many eastern states including nearby Ohio and Pennsylvania. It is recorded feeding on ironweed (*Vernonia sp.*) and asters (*Aster sp.*).

Specimen Data: Essex Co., Windsor, Ojibway Prairie Prov. Nat. Res., 1 ♂ 27 May 2000, S.A. Marshall; 2 ♂♂, 3 May 2001, O. Lonsdale; 5 ♂♂ 5 ♀♀, yellow pans, 3-22 May 2001, S.M. Paiero; 4 ♂♂ 1 ♀, sweep, 30 May 2001, S. Goodfellow; 1 ♂, yellow pans, 8-12 June 2001, Fawdry & Kuipers; 1 ♂, yellow pans, 12-15 June 2001, S.M. Paiero; 1 ♂, yellow pans, 10-14 August 2001, S.M. Paiero; 1 ♂ 1 ♀, yellow pans, 28 September-5 October 2001, S.M. Paiero; 2 ♂♂, yellow pans, 30 May 2002, S.M. Paiero; 1 ♂ 1 ♀, 18-19 June 2002, O. Lonsdale; 1 ♀, Windsor, ~1.5 km S Ojibway Prairie Prov. Nat. Res., malaise, 5-12 June 2001, S.M. Paiero.

Telamona fitchi Ball

This species is newly recorded from Canada. It is a rare species previously known from Maryland, New York and Pennsylvania (Ball 1931). Its plant host is unknown.

Specimen Data: Lambton Co., 1 ♀ (CNCI), Port Franks, Karner Blue Sanctuary, 1 September 1994, K. Stead.

Telamona gibberata Ball

This species is newly recorded from Canada. Ball (1931) records it on hackberry (*Celtis*), but one specimen recorded here was found on blue beech (*Carpinus caroliniana* Walt.). This species shows considerable sexual dimorphism in the pronotal crest shape. Kopp and Yonke (1974) record it from Illinois, Iowa, Nebraska, New Jersey, Texas and Louisiana.

Specimen Data: Lambton Co., 1 ♀ (CNCI), Sarnia, 14 July 1974, K.G.A. Hamilton; Prince Edward Co., 1 ♂ (CNCI), 28 June 1945, Brimley; 1 ♂ (CNCI), "beaten from blue beech", 14 August 1937, Brimley.

3) Suborder Sternorrhyncha

Although the recent checklist does cover the Sternorrhyncha, these generally small, soft-bodied insects are not as well documented as the other Hemiptera suborders. Because they often require special preparation, and because most taxa are identifiable only by a few specialists, they have not been significant components of recent survey projects. Nonetheless, we can point to a few species of Ontario Sternorrhyncha that were not included in Maw et al. (2000). The following Sternorrhyncha can be added to our fauna:

Coccidae

Neolecanium cornuparvum (Thro)

The genus and species are newly recorded from Canada. The conspicuous Magnolia Scale, the largest scale in eastern North America, was not included in Maw et al. (2000), although it is an established pest of *Magnolia* in southern Ontario.

Specimen Data: Hamilton-Wentworth Reg., 1 ♀ (photo only), Hamilton, Royal Botanical Gardens, August 1998, S.A. Marshall.

Pseudococcidae

Pseudococcus longispinus (Targioni & Tozzetti)

The Long-tailed Mealybug is a well-known pest in many parts of the world, but has not been formally recorded from Canada. It is a common pest on greenhouse and house plants in southern Ontario.

Specimen Data: Wellington Co., 1 ♀ (photo only), Guelph, University of Guelph, in greenhouse, September 1998, S.A. Marshall.

Psyllidae

Pachypsylla celtidisinteneris Mally

This species is newly recorded from Canada. Like other *Pachypsylla*, *P. celtidisinteneris* forms galls on hackberry trees (*Celtis* spp.) (Tuthill 1943). It has previously been recorded from Iowa, Illinois and Ohio (Tuthill 1943).

Specimen Data: Essex Co., 1 ♀, Pelee Island, Fish Point Pro. Nat. Res., 7 June 2002, S.M. Paiero; Middle Island, 11 June 2003, S.A. Marshall, 1 ♂, (collecting method not indicated); 6 ♂♂ 2 ♀♀, shore, yellow pans; 2 ♀♀, yellow pans in mud; 1 ♂ 3 ♀♀, cormorant colony, yellow pans.

4) Status of some previously recorded species

Skevington et al. (2001) also record several taxa not listed in Maw et al. (2000). Of these, we were able to confirm *Lepyronia gibbosa* Ball (Cercopidae) and *Trionymus winnemuciae* McKenzie (Pseudococcidae) as present in Ontario. Specimens for two species recorded in Skevington et al. (2001), *Merocoris typhaeus* (Fabricius) (Coreidae) and *Balclutha manitou* (Gillette and Baker) (Cicadellidae), were examined and found to be misidentified specimens of *M. distinctus* Dallas and *B. impicta* (Van Duzee) respectively. One specimen was tentatively identified as *Telamona gibbera* Ball but was reidentified as *Telamona fitchi* Ball (see above). *Aphis hamamelidis* Pepper was also recorded as new to Ontario, but we were unable to confirm its presence.

One pentatomid, *Stiretrus anchorago* (Fabricius), was previously recorded in Ontario (McPherson 1982), but was not included in Maw et al. (2000). Its omission from the checklist occurred presumably because no specimens were found in Canadian collections. Its presence in Ontario is confirmed with the collection of several specimens (2♂♂6♀♀) from the Ojibway Prairie Provincial Nature Reserve.

Other records in the literature since Maw et al. (2000) include *Erythroneura carbonata* McAtee, recorded by Sauer (2002) as new to Ontario from the Ojibway Prairie Provincial Nature Reserve, and *Aphis glycines* Matsumura, recorded by Larsen et al. (2002) in Ontario.

Discussion

Although Maw et al. (2000) provided a comprehensive list of Hemiptera taxa known from Canada at that time, we list eight Heteroptera, twenty-one Auchenorrhyncha and three Sternorrhyncha species new to Canada since then, as well as an additional four Heteroptera and three Auchenorrhyncha new to Ontario. Although some of these new records merely represent previously undocumented northern outliers of species widespread south of the border, many of the new records are species that previously escaped detection because they are rare or highly habitat-restricted in Canada. Species in the latter category are of particular interest as potentially threatened or endangered species but further study is required.

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References

- Ball, E.D. 1931. A monographic revision of the treehoppers of the tribe Telamoniini of North America. *Entomologica Americana*, 12: 1-69.
- Barber, H.G. 1929. Essay on the subfamily Stenopodinae of the New World. *Entomologica Americana*, 10: 149-238.
- Barber, H.G. 1932. Two Palearctic Hemiptera in the Nearctic fauna (Heteroptera-Pentatomidae: Nabidae). *Proceedings of the Entomological Society of Washington*, 34:65-66.
- Beamer, R.H. 1946. The genus *Stenocranus* in America north of Mexico (Homoptera, Fulgoridae, Delphacinae). *Journal of the Kansas Entomological Society*, 19: 1-11.
- Blades, D.C.A. and S.A. Marshall. 1994. Terrestrial arthropods of Canadian peatlands: Synopsis of pan trap collections at four southern Ontario peatlands. *Memoirs of the Entomological Society of Canada*, 169: 221-284.
- Bouchard, P., K.G.A. Hamilton and T.A. Wheeler. 2002. Diversity and conservation status of prairie endemic Auchenorrhyncha (Homoptera) in alvars of the Great Lakes region. *Proceedings of the Entomological Society of Ontario*, 132 (2001): 39-52.

- Dozier, H.L. 1926. The Fulgoridae or Planthoppers of Mississippi, including those of possible occurrence. Mississippi Agriculture Experimental Station Technical Bulletin No. 14. 152 pp.
- Hagerty, A.M. and J.E. McPherson. 1999. Survey of the Reduviidae (Heteroptera) of southern Illinois, excluding the Phymatinae, with notes on biology. The Great Lakes Entomologist, 32: 133-160
- Hamilton, K.G.A. 1970 The genus *Cuerna* (Homoptera: Cicadellidae) in Canada. Canadian Entomologist, 102: 425-441.
- Hamilton, K.G.A. 1985. Leafhoppers of Ornamental and Fruit Trees in Canada. Agriculture Canada Publication 1779/E. 71 pp.
- Hamilton, K.G.A. 1992. Leafhopper evidence for origins of northeastern relict prairies (Insecta: Homoptera: Cicadellidae), pp. 61-70 in: R.G. Wickett et al., eds. Proceedings of the Thirteenth North American Prairie Conference: Spirit of the Land, our Prairie Legacy. Preney Print & Litho.
- Hamilton, K.G.A. and D.W. Langor. 1987. Leafhopper fauna of Newfoundland and Cape Breton Islands (Rhynchota: Homoptera: Cicadellidae). Canadian Entomologist, 119: 663-695.
- Harris, H.M. 1928. A monographic study of the hemipterous family Nabidae as it occurs in North America. Entomologica Americana, 9: 1-97.
- Kopp, D.D. and T.R. Yonke. 1973a. The treehoppers of Missouri: Part 1. Subfamilies Centrotinae, Hoplophorioninae, and Membracinae (Homoptera: Membracidae). Journal of the Kansas Entomological Society, 46: 42-64.
- Kopp, D.D. and T.R. Yonke. 1973b. The treehoppers of Missouri: Part 2. Subfamily Smiliinae; Tribes Acutalini, Ceresini, and Polyglyptini (Homoptera: Membracidae). Journal of the Kansas Entomological Society, 46: 233-276.
- Kopp, D.D. and T.R. Yonke. 1974. The treehoppers of Missouri: Part 4. Subfamily Smiliinae; Tribe Telamonini (Homoptera: Membracidae). Journal of the Kansas Entomological Society, 47: 80-130.
- Lattin, J.D. 1966. *Stalia major* (Costa) in North America. Proceedings of the Entomological Society of Washington, 68: 314-318.
- Larivière, M.-C. 1992. *Himacerus apterus* (Fabricius), a Eurasian Nabidae (Hemiptera) new to North America: diagnosis, geographical distribution, and bionomics. Canadian Entomologist, 124: 725-728.
- Larsen, R.C., C. Grau, K.C. Eastwell, A.M. Mondjana, P.N. Miklas and W.R. Stevenson. 2002. A virus disease epidemic of snap bean occurring in the Great Lakes region of the USA. Phytopathology, 92 (Supplement 6): S44.
- Maw, H.E.L., R.G. Footitt, K.G.A. Hamilton and G.G.E. Scudder. 2000. Checklist of the Hemiptera of Canada and Alaska. NRC Research Press. 220 pp.
- McPherson, J.E. 1982. The Pentatomoidea (Hemiptera) of Northeastern North America with an emphasis on the fauna of Illinois. Southern Illinois University Press. 240 pp.
- Metcalf, Z.W. 1923. The Fulgoroidea of eastern North America. Journal of the Elisha Mitchell Society, 38: 139-230.
- Pechuman, L.L. and A.G. Wheeler Jr. 1981. Northern range extension of *Acanalonia conica* (Homoptera: Acanaloniidae). Entomological News, 92: 98-100.
- Penner, L.R. 1947. Some notes on the genus *Pentagramma* and four new species (Homoptera, Delphacidae, Asiracinae). Journal of the Kansas Entomological Society, 20: 30-39.
- Sauer, S.B. 2002. Midwestern occurrences of *Erythroneura carbonata* McAtee (Hemiptera: Cicadellidae) and host associations with species of *Lysimachia* (Primulaceae). Journal of the Kansas Entomological Society, 75: 339-340.

- Sinada, N.A. and H.D. Blocker. 1994. A revision of the new world *Polyamia* (Homoptera: Cicadellidae). *Annals of the Entomological Society of America*, 87: 771-794.
- Skevington, J., D. Caloren, K. Stead and J. Connop. 2001. *Insects of North Lambton*. Lambton Wildlife Incorporated. 181 pp.
- Slater, J.A. and R.W. Baranowski. 1978. *How to Know the True Bugs*. Pictured Key Nature Series. William C. Brown Publishers. 257 pp.
- Slater, J.A. and R.W. Baranowski. 1990. *Arthropods of Florida and neighboring land areas Volume 14: Lygaeidae of Florida (Hemiptera: Heteroptera)*. Florida Department of Agriculture and Consumer Services. 211 pp.
- Sorenson, J.T., B.C. Campbell, R.J. Gill and J.D. Steffen-Campbell. 1995. Non-monophyly of Auchenorrhyncha ("Homoptera"), based upon 18s rDNA phylogeny: Eco-evolutionary and cladistic implications within pre-Heteropteroidea Hemiptera (s.l.) and a proposal for new monophyletic suborders. *Pan-Pacific Entomologist*, 7: 31-60.
- Tsai, J.H., and D.D. Kopp. 1980. Life history, morphology, and taxonomy of *Acutalis tartarea* (Say) (Homoptera: Membracidae). *Journal of the New York Entomological Society*, 88: 174-185.
- Tuthill, L.D. 1943. The Psyllids of America North of Mexico (Psyllidae: Homoptera). *Iowa State College Journal of Science*, 17: 443-660.
- Van Duzee, E.P. 1917. *Catalogue of the Hemiptera of America North of Mexico Volume 2*. University of California Press. xiv + 902 pp.
- Wheeler, A.G., Jr. 1976. *Anaptus major* established in eastern North America (Hemiptera: Nabidae). *Proceedings of the Entomological Society of Washington*, 78: 382.
- Wilson, S.W. and J.E. McPherson. 1980a. A list of the host plants of the Illinois Acanaloniidae and Flatidae (Homoptera: Fulgoroidea). *Transactions of the Illinois State Academy of Science*, 73(4): 21-29.
- Wilson, S.W. and J.E. McPherson. 1980b. The distribution of the Fulgoroidea of the eastern USA. *Transactions of the Illinois Academy of Science*, 73(4): 7-20.
- Wilson, S.W. and J.E. McPherson. 1981a. Life history of *Megamelus davisii* with description of immature stages. *Annals of the Entomological Society of America*, 74: 345-350.
- Wilson, S.W. and J.E. McPherson. 1981b. Life histories of *Anormenis septentrionalis*, *Metcalfa pruinosa*, and *Ormenoides venusta* with descriptions of immature stages. *Annals of the Entomological Society of America*, 74: 299-311.
- Wilson, S.W., J.L. Smith and P.D. Calvert. 1993. Planthoppers of a Missouri tallgrass prairie (Homoptera: Fulgoroidea). *Journal of the Kansas Entomological Society*, 66: 75-80.
- Young, D.A. 1977. Taxonomic Study of the Cicadellinae (Homoptera: Cicadellidae), Part 2. New World Cicadellini and the Genus *Cicadella*. North Carolina Agricultural Experiment Station Technical Bulletin 239. 1153 pp.

the following: (1) the physician's duty to his patient; (2) the physician's duty to his fellow physicians; (3) the physician's duty to his community; and (4) the physician's duty to himself.

The first of these duties is the physician's duty to his patient. This duty is the most important of all, and it is the one that is most often violated.

The second of these duties is the physician's duty to his fellow physicians. This duty is also very important, and it is the one that is most often violated.

The third of these duties is the physician's duty to his community. This duty is also very important, and it is the one that is most often violated.

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HOST LOCATION BEHAVIOUR IN *PELECINUS POLYTURATOR* (HYMENOPTERA: PELECINIDAE)

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Pelecinus polyturator (Drury) (Hymenoptera: Pelecinidae) is a relatively common endoparasitoid wasp of June beetles, *Phyllophaga* spp. (Coleoptera: Scarabaeidae) (Masner 1993; Johnson et al. 1999). Its range extends from southeastern Canada to central Argentina (Johnson and Musetti 1998). It exhibits "geographic parthogenesis" (Brues 1928) in which tropical populations are bisexual whereas temperate populations consist predominantly of thelytokous females (Johnson and Musetti 1998). Only three extant species comprise the genus and family (Johnson and Musetti 1999) and the relationships of the family within the Proctotrupoidea are unclear (see Koenigsmann 1978; Gibson 1985; Rasnitsyn 1988; Dowton et al. 1997). Despite the large size of *P. polyturator* (body length up to 6 cm) and its relatively common occurrence in deciduous forests of eastern North America, little has been documented about its biology and behaviour. Lim et al. (1980) described the pupa (from one specimen), Aguiar (1997) described its mating behaviour (from one pair) and Johnson et al. (1999) described the larva (from five specimens). Descriptions of the collection of live *P. polyturator* have been made for over 100 years (e.g., Ashmead 1902; Brues 1928) and yet a detailed account of host location behaviour and/or oviposition has never been made. The only previous description of these behaviours was made by Davis (1919) who reported that *P. polyturator* inserts its entire metasoma into the soil during host location. The current short communication describes and quantifies the elements of host location behaviour of *P. polyturator* for the first time.

A female *P. polyturator* was collected by hand (CANADA, Ontario, York Region, nw. of Newmarket, 28 August 1996, Bennett) (voucher deposited at the Canadian National Collection of Insects, Ottawa). It was kept in the laboratory in a terrarium, the bottom six cm of which was filled with potting soil. Twenty-four third instar *Phyllophaga* sp. grubs were added to the soil and allowed to burrow. A Panasonic Omnimovie® video camera was used to record the interactions.

Under a white 60 W incandescent light bulb, no probing of the soil with the metasoma was seen for two days; however, within ten minutes of changing the light source to a red 60 W incandescent bulb, probing was observed. During six hours of observation, the wasp spent most of the time (more than five hours) wandering the terrarium (wandering behaviour) with no apparent interest in the grubs moving in the soil below. Host location behaviour was considered to have commenced when the wasp's antennae ceased movement completely and the distal segments appeared to be touching the soil. At this time, the metasoma was not in contact with the soil, but was held aloft with the distal segments curved downwards and anteriorly towards the mesosoma. After a period of time (usually less than ten seconds), the wasp rotated its body (rotation behaviour) to orient its head over a new area of soil and once again ceased movement. The rotation of the body (as seen in dorsal view) was 30 – 270° from the original direction when motion ceased (usually 90 – 180°). There was no discernible pattern to the angle of rotation or to the direction (clockwise, counter-clockwise, or alternating). Rotation of the body was usually, but not always, followed by insertion of the metasoma into the soil. If insertion did not occur, the wasp returned to wandering behaviour. The duration of rotation behaviour ranged from 35 – 240 seconds (mean = 95 seconds; n = 8).

Insertion of the metasoma was witnessed seven times in six hours. In order to insert the metasoma into the soil, the wasp held the first and second metasomal segments vertically upwards and the third and distal segments curved downwards and anteriorly toward the mesosoma. The posterior end of the second metasomal segment was then levered down to a horizontal position, which pushed the distal segments into the soil. Insertion was also facilitated by side to side movement of the metasoma, by twisting of the body around the point of insertion, and by raking of the hind tarsi to pull soil from the insertion point. Occasionally one hind leg was used to brace the metasoma as it entered the soil and the wasp sometimes climbed partially up the side of the terrarium to help lever the metasoma into the soil. The flexibility of the metasoma (as reported by Mason 1984) allowed the wasp to probe not only vertically down into the soil, but also horizontally in a posterior or anterior direction. On several occasions, the entire length of the metasoma and much of the mesosoma was inserted (Fig. 1), showing that *P. polyturator* can reach grubs up to 5 cm below the soil surface.

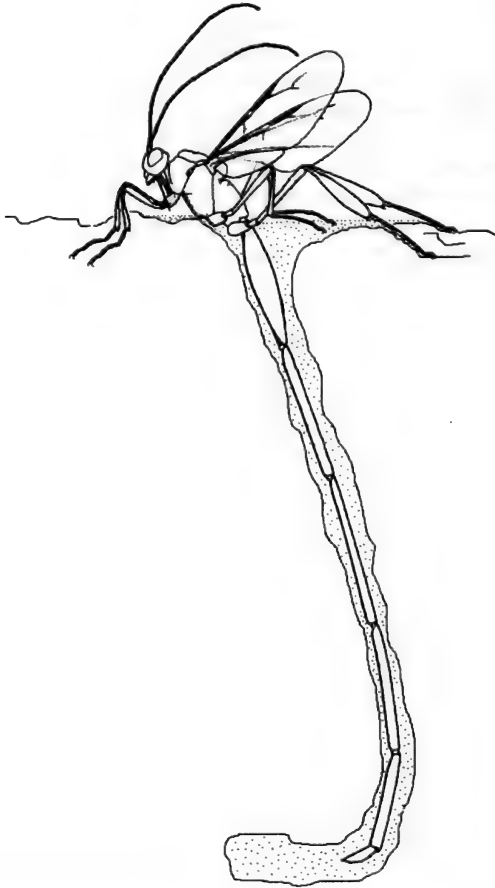


FIGURE 1. Female *Pelecinus polyturator* with metasoma completely inserted into soil during host location.

Metasomal insertion lasted 67 – 407 seconds (mean = 145 seconds; $n = 7$). In five of the insertions, the metasoma was removed completely from the soil after probing, whereas in the other two, removal was incomplete, followed by re-insertion and re-positioning of the metasoma in the soil. Removal of the metasoma from the soil was rapid, and once completely removed, grooming of the metasoma and wings with the hind legs ensued (10 – 25 seconds duration). Oviposition into the grubs was not witnessed. The grubs seemed agitated when the wasp's metasoma was probing near them. During one metasomal insertion, a grub moved rapidly away from the tip of the metasoma when it entered a gallery in which the grub was present. Later dissection of all the grubs revealed no larvae.

Because this study is based on only one individual, a comparative discussion is not warranted. It should be noted; however, that there is an almost complete lack of knowledge of host-searching and/or oviposition behaviour in the entire superfamily Proctotrupoidea to which the Pelecinidae belongs and so any information is valuable (see Huggert 1979 on the proctotrupid *Cryptoserphus foveolatus* (Möller); Deyrup 1985 on the vanhorniid *Vanhornia eucnemidarum* Crawford). Attempts to replicate my observations and to witness oviposition have been unsuccessful over the last eight years which is the reason why the study is presented here as a short communication. Hopefully these observations will stimulate and complement future investigations on host location and oviposition behaviour of *P. polyturator* and other species with poorly known biology.

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References

- Ashmead, W.H. 1902. Classification of the pointed-tail wasps, or the superfamily Proctotrypidae — I. Journal of the New York Entomological Society, 10: 240-247.
- Aguiar, A.P. 1997. Mating behavior of *Pelecinus polyturator* (Hymenoptera: Ichneumonidae). Entomological News, 108: 117-121.
- Brues, C.T. 1928. A note on the genus *Pelecinus*. Psyche, 35: 205-209.
- Davis, J.J. 1919. Contributions to a knowledge of the natural enemies of *Phyllophaga*. Illinois State Natural History Survey Bulletin, 13: 53-138.
- Deyrup, M. 1985. Notes on the Vanhorniidae (Hymenoptera). Great Lakes Entomologist, 18: 65-68.
- Dowton, M., A.D. Austin, N. Dillon, and E. Bartowsky. 1997. Molecular phylogeny of the apocritan wasps: the Proctotrupomorpha and Evanioromorpha. Systematic Entomology, 22: 245-255.
- Gibson, G.A.P. 1985. Some pro- and mesothoracic structures important for phylogenetic analysis of Hymenoptera, with a review of terms used for the structures. The Canadian Entomologist, 117: 1395-1443.
- Huggert, L. 1979. *Cryptoserphus* and Belytinae wasps (Hymenoptera, Proctotrupoidea) parasitizing fungus- and soil-inhabiting Diptera. Notulus Entomologicae, 59: 139-144.
- Johnson, N.F. and L. Musetti. 1998. Geographic variation in sex ratio in *Pelecinus polyturator* (Drury) (Hymenoptera: Pelecinidae). Journal of Hymenoptera Research, 7: 48-56.
- Johnson, N.F. and L. Musetti. 1999. Revision of the proctotrupoid genus *Pelecinus* Latreille (Hymenoptera: Pelecinidae). Journal of Natural History, 33: 1513-1543.

- Johnson, N.F., L. Musetti, J.B. Johnson and K. Katovich. 1999. The larva of *Pelecinus polyturator* (Drury) (Hymenoptera: Peleciniidae). Proceedings of the Washington Entomological Society, 101: 64-68.
- Koenigsmann, E. 1978. Das phylogenetische System der Hymenoptera. Teil 3: Terebrantes (Unterordnung Apocrita). Deutsche Entomologische Zeitung, 25: 1-55.
- Lim, K.P., W.N. Yule, and R.K. Stewart. 1980. A note on *Pelecinus polyturator* (Hymenoptera: Peleciniidae), a parasite of *Phyllophaga anxia* (Coleoptera: Scarabaeidae). The Canadian Entomologist, 112: 219-220.
- Masner, L. 1993. Superfamily Proctotrupoidea. pp.537-557. In H. Goulet and J.T. Huber (eds.) Hymenoptera of the World: An Identification Guide to Families. Agriculture Canada Publication 1894/E 794 pp.
- Mason, W.R.M. 1984. Structure and movement of the abdomen of female *Pelecinus polyturator* (Hymenoptera: Peleciniidae). The Canadian Entomologist, 116: 419-426.
- Rasnitsyn, A.P. 1988. An outline of the evolution of the hymenopterous insects (Order Vespida). Oriental Insects, 22: 115-145.

**EVIDENCE FOR THE EXTIRPATION OF *CEROPALES BIPUNCTATA* SAY
(HYMENOPTERA: POMPILIDAE) IN ONTARIO**

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A resurgence of interest in taxonomy has been fueled both by the application of new technologies (e.g., DNA sequencing) and an interest in preserving biodiversity (Mallet and Willmott 2003). The latter interest requires not only the description of new taxa, but also attention to the status of species already known, particularly in groups that are infrequently studied. This paper argues that a species of spider wasp (Pompilidae), a group of generally dark, hairless, long legged wasps, that are prone to quick movements and wing twitching in the field and which receive sporadic taxonomic attention, has become extirpated in Ontario. *Ceropales bipunctata* is a relatively conspicuous wasp, distinguished from most other pompilids in Ontario by its red metafemur, robust appearance and large size (forewing 9-16mm long (Townes 1957)) (Fig. 1; <http://www.uoguelph.ca/~samarsha/ceropales.htm>). Although this species seems to have been common in Ontario, it has not been collected there in the past forty-five years.

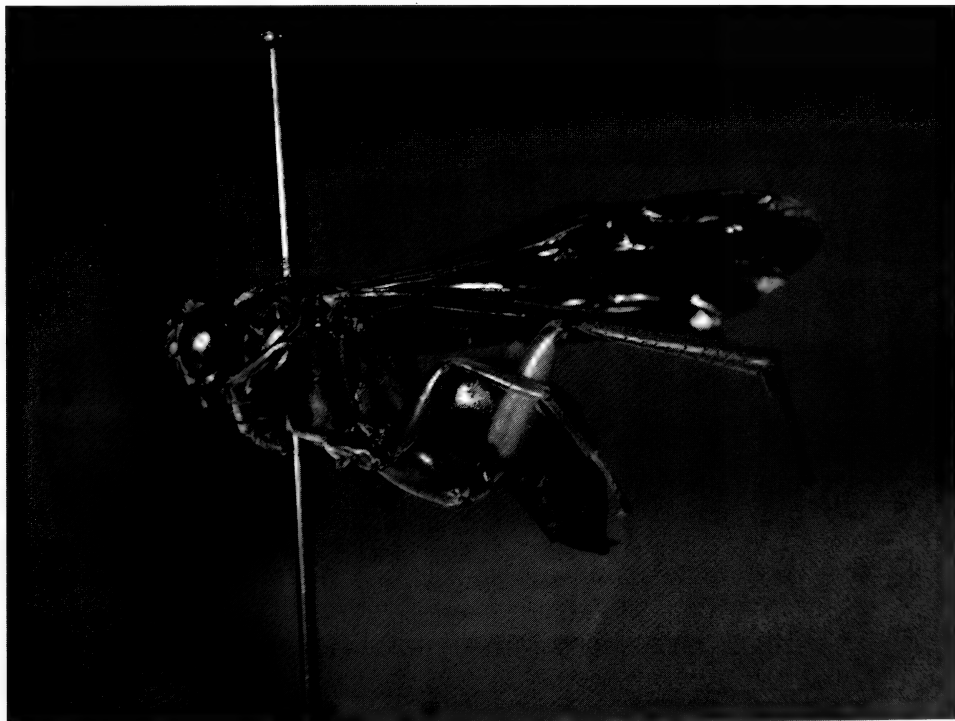


FIGURE 1. Habitus of *C. bipunctata*, a species that can be distinguished from other Ontario pompilids by its robust appearance and metafemur (the second segment visible on the hind leg in this photo). See <http://www.uoguelph.ca/~samarsha/ceropales.htm> for a colour version of this photograph.

To quantify the decline of *C. bipunctata* in Ontario, I examined all specimens of this species in Ontario's three largest insect collections: the Canadian National Collection [CNCI] in Ottawa, the Royal Ontario Museum [ROME] collection in Toronto and the Department of Environmental Biology, University of Guelph insect collection [DEBU] in Guelph. I verified unidentified material where practical. Together these collections contained 105 specimens (see Appendix 1). Six of the specimens were from other provinces in eastern Canada, and twenty-four contained no locality information (presumably most of them are from Ontario). Informal inquiries were made at the American Museum of Natural History [AMNH], University of Michigan [UMMZ], the Harvard Museum of Comparative Zoology [MCZC] and with Dr. Marius Wasbauer. These four collections contained 163 specimens and produced one Canadian record, housed at UMMZ and collected in Toronto on 10 August 1892. Provancher (1889) provides an additional record, from a specimen collected by M. Guignard in Ottawa.

Ceropales bipunctata was collected consistently in Ontario between the 1880s and the 1950s (Fig. 2). The species was widely distributed in southern Ontario (Fig. 3) and has been collected in this province by at least seventeen people. One collector (N. K. Bigelow) collected *C. bipunctata* at two separate locations, Orono and Port Hope, on two consecutive days, while another (W. M. Brodie) collected a series of thirty-six specimens in Toronto over a period of twenty-seven years (1880-1907). These observations suggest that *C. bipunctata* was common in accessible habitats in Ontario in the late 19th and early 20th century. This picture is consistent with observations made by Townes (1957), that *C. bipunctata* is "commonly collected on *Solidago* flowers", an abundant group of flowers in old fields in Ontario (Semple et al. 1999). It is also consistent with the remarks of Harrington (1908) who found the species abundant at least once near the northern limit of its range; "One year it [*C. bipunctata*] was abundant in the Beaver Meadow (Hull [Quebec]) on the flowers of *Spirea*, but since then I have only taken one male". The species seems to have declined in the 1950s. The last Ontario specimen of *C. bipunctata* was collected in Kingston by

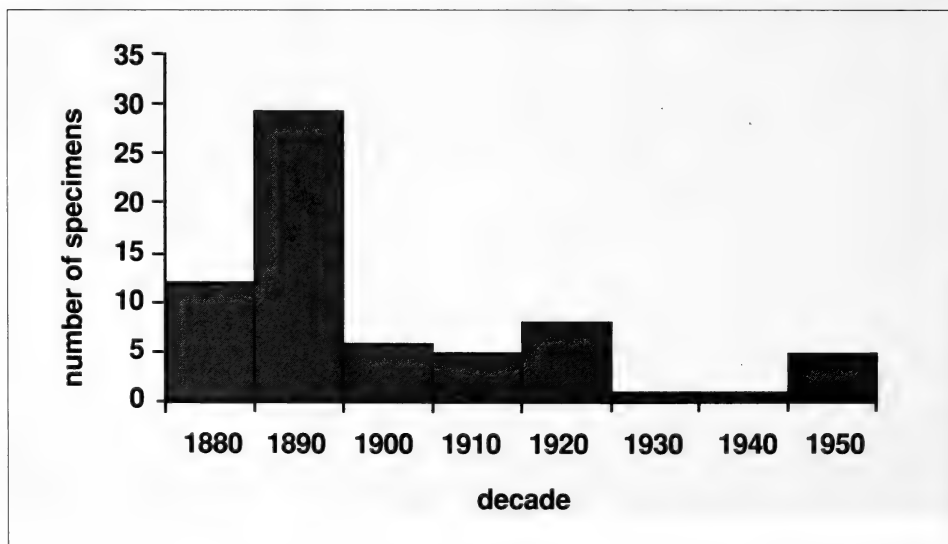


FIGURE 2. The number of Ontario specimens of *C. bipunctata* deposited per decade in the University of Guelph, Royal Ontario Museum and Canadian National Collections. This species has not been collected in Ontario since 1957. Only specimens with location labels were included.

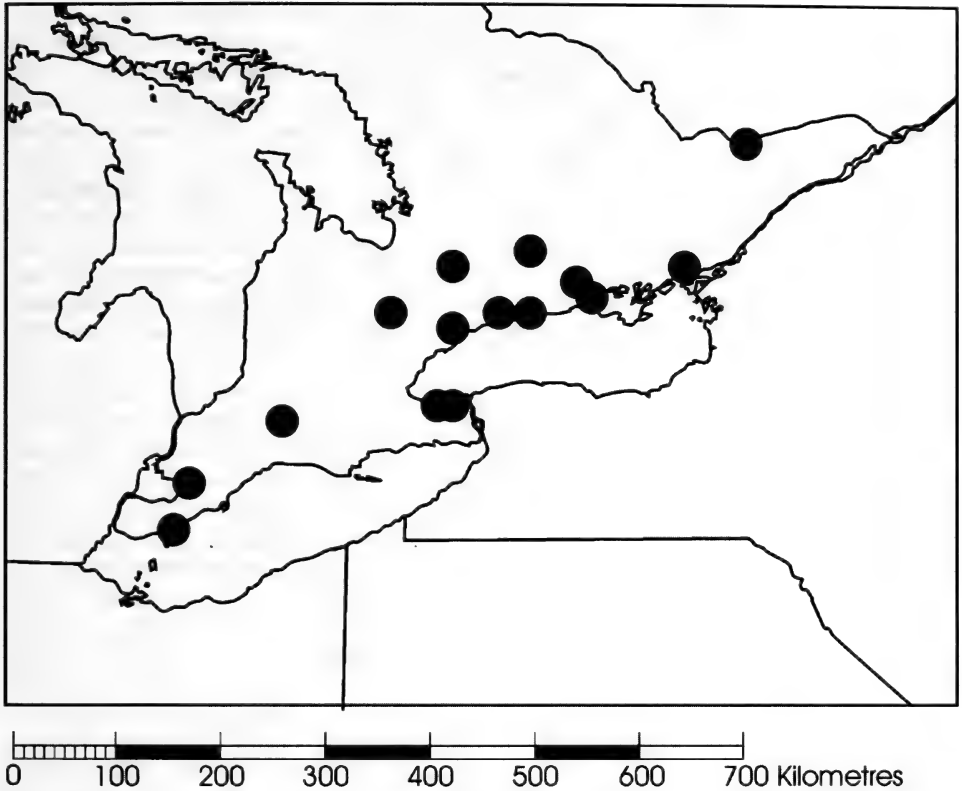


FIGURE 3. Historical range of *C. bipunctata* in Ontario, based on specimens deposited in Ontario's three largest insect collections.

E.H. Martin in 1957. Though the collections I contacted collectively housed nearly three hundred specimens, there were no Canadian records from later than the 1950s, and no American records from later than the early 1960s.

While it may be impossible to determine the reason for this decline, one can speculate on a few potential causes. Species of *Ceropaltes* are cleptoparasites on other pompilids (Day 1988). *Ceropaltes bipunctata* may have been susceptible to declines in either its pompilid hosts or the spiders that the hosts preyed upon (M. Wasbauer pers. com.). While I was unable to find host records, *C. bipunctata*'s large size probably forced it to specialize on a small number of large pompilids such as some members of the genus *Anoplius*. This specialization may have made the species more vulnerable than most cleptoparasites. Shaw and Hochberg (2001) point out that a large swath of the parasitic hymenoptera may be similarly vulnerable because of their dependence on particular host species. Pesticides might also be a factor, particularly given that *C. bipunctata* declined during a period of increased pesticide use. Both pesticides and pathogens have been suggested as possible causes for a similar decline in populations of *Nicrophorus americanus* Olivier (Coleoptera: Silphidae) (Sikes and Raithel 2002).

Some change in collecting effort or methods might also affect the number of specimens taken (a decrease in hand collecting in favor of passive methods might theoretically decrease the

number of specimens taken of a showy species like *C. bipunctata* for example). This, however, seems to be a partial explanation at best. *C. bipunctata* is a large and attractive species and it is unlikely that it would be ignored by Ontario naturalists for forty-five years. This coupled with its absence from recent biological surveys such as those of Point Pelee (S. Marshall pers. com.), north Lambton County (Skevington et al. 2001) and oak savannahs (Sugar et al. 1998) strongly suggest that the apparent decline is not due to a lack of collecting.

The pattern of decline in this species is also consistent with those of at least two other Ontario insects that are now believed to be extirpated. The decline of *Nicrophorus americanus* Olivier, a large and showy carrion beetle, was first noticed because of a lack of specimens in recent collections (Baldwin 1975; Davis 1980). *N. americanus* is now believed to occupy less than 10% of its historic range (Sikes and Raithel 2002). Similar work has also shown a decline in *Polystoechotes punctatus* (Fabricius) (Neuroptera: Polystoechotidae), which has not been collected in Ontario since the 1950s (Marshall 1996).

It is important for Ontario naturalists to look for *C. bipunctata*. It is relatively distinctive and so either a collected specimen or a good photograph should suffice for the purposes of identification. This species should also be noted in areas outside of Ontario. Townes (1957) reported *C. bipunctata* from nearly all of eastern North America and considering the lack of recent specimens in the American collections contacted it is possible that the species has declined throughout a major part of its range. *Ceropales bipunctata* is most likely to be found in late summer (half of the Ontario records occurred between August the 13th and September the 4th) in open areas with flowers.

Appendix 1: Specimens of *C. bipunctata* in the collections visited.

W. M. Brodie=WMB

Ontario: Bobcaygeon: 29 August 1954, R. Lambert [CNCI]; Chatham: 21 August 1913, F. W. Sladen [2 specimens, CNCI]; 5 August 1948, John Martin Collection [CNCI]; Degra Point: 13 August [19]14, E. M. Walker [ROME]; Grimsby: 10 September, [18]94 [collector unknown, CNCI]; Hastings: 1 September [19]04, Evans [CNCI]; Hyde Park Corner: 11 August [19]02, J. A. Morden [CNCI]; Jordan: 16 September 1914, W. A. Ross [DEBU]; Kingston: 26 July 1957, J. E. H. Martin [CNCI]; Orono: 3 September [19]25, N. K. Bigelow [4 specimens; ROME]; London: W. H. Saunders [no date, 2 specimens, DEBU]; Orangeville: 19 August 1954, D. H. Pengelly [DEBU]; Ottawa: 22 August [18]93, W. Harrington collection [CNCI]; 14 August 1912, JIB [CNCI]; W. H. Harrington [date unknown, CNCI]; [no collector or date, Det. Townes 1949, CNCI]; W. H. Harrington [date unknown, DEBU]; Point Pelee: 13 August 1920, N. K. Bigelow [ROME]; 23 August [19]20, [no collector, ROME]; 9 September 1954, C. D. Miller [CNCI]; 9 September 1954, W. R. Mason [CNCI]; Port Hope: 4 September [19]25, N. K. Bigelow [2 specimens, ROME]; Toronto: 16 September [18]80, WMB [ROME]; 17 September [18]80, WMB [2 specimens, ROME]; 20 September [18]84, WMB [ROME]; 20 ? [18]84 [no collector, ROME]; 20 August [18]85, WMB [ROME]; 9 August [18]86, WMB; 2 July [18]87, WMB [ROME]; 20 August [18]88, WMB [2 specimens, ROME]; 29 September [18]88, WMB [ROME]; 8 9 ? 8 August [18]89 [collector unknown, CNCI]; 7 August [18]90, WMB [ROME]; 28 August [18]90, WMB [ROME]; 30 August [18]90, WMB [2 specimens, ROME]; 30 August [18]90 [no collector, ROME]; 18 June [18]91, WMB [ROME]; 28 August [18]91, [collector unknown, CNCI]; 4 September [18]91, WMB [ROME]; 13 September [18]91, WMB [2 specimens, ROME]; 2 September [18]92, WMB [ROME]; 3 September [18]92, WMB [ROME]; 10 August [18]93, WMB [ROME]; 20 August [18]93, WMB [2 specimens, ROME]; 23 August [18]93, WMB [ROME]; 25 August [18]93 [collector unknown, CNCI]; 28 August [18]93, WMB [ROME]; 2 September [18]93 [2 specimens, collector unknown,

CNCI]; 3 September [18]93, WMB [ROME]; 10 September [18]93, WMB [ROME]; 2 July [18]94, WMB [ROME]; 24 August [18]94, WMB [ROME]; 9 8 [?] 9 July 18]94, [collector unknown, CNCI]; 25 August [18]95, WMB [ROME]; 1 September [18]95, WMB [ROME]; ?2 April [19]07, WMB [ROME]; 12 August [19]07, WMB [ROME]; WMB [no date, 2 specimens, ROME]; 1 September 1934, F. A. Urquhart [ROME]; Trenton: 20 September 1903, Evans [CNCI]; 10 September [19]05, [collector unknown, CNCI]; **New Brunswick:** Chippigan: 28 July 1939, J. McDunnough [CNCI]; Tracadie: 30 July 1939, J. McDunnough [CNCI] **Prince Edward Island:** Brackley Beach: 14 July 1940, J. McDunnough [CNCI]; **Quebec:** Hemmingsford: 5 September 1925, T. Armstrong [CNCI]; 26 August 1931, J. B. Maltais [CNCI]; Hull: 8 August 1921, Tae [CNCI] **No location: [?Ontario]:** 25 August 1916 [illegible, CNCI]; division of entomology Ottawa Canada [this is an institutional label not a locality, no date, Det. Townes 1949, CNCI]; specimens G320-324 [CNCI]; Det. Townes 1949 [no other information, CNCI]; 9 August [19]07, WMB [ROME]; 13 August [19]07, WMB [ROME]; 28 August ?1888, WMB [2 specimens; ROME]; WMB [no date, 10 specimens, ROME]; 6 August [18]86, WMB [2 specimens ROME]; [Unlabelled; DEBU].

Acknowledgments

I thank Chris Darling, John Huber and Steve Marshall for giving me access to the ROME CNCI and DEBU collections respectively. Gary Parsons kindly gave me a list of all specimens from UMMZ, while Valerie Giles and Stefan Cover checked the AMNH and MCZC collections. Helpful comments were provided by: Anurag Agrawal, Andrew Bennet, Matthias Buck, Henri Goulet, John Huber, Marc Johnson, Steve Marshall, Lubomir Masner, Marius Wasbauer and two anonymous peer reviewers. Jason Dombroskie kindly provided the photo of *C. bipunctata*. Ian Smith provided the map of Ontario while Dave Cheung designed the web page.

References

- Baldwin, B. 1975. A Faunal Study of Illinois Silphidae (Coleoptera). M.S. Thesis, University of Illinois, Urbana, IL. 83 pp.
- Davis L. R. 1980. Notes on beetle distributions, with a discussion of *Nicrophorus americanus* Olivier and its abundance in collections (Coleoptera: Scarabaeidae, Lampyridae, and Silphidae). *Coleopterist's Bulletin* 34: 245-251.
- Day, M. C. 1988. Spider wasps: Hymenoptera: Pompilidae. Handbooks for the Identification of British insects. Vol. VI, Part 4. Royal Entomological Society of London, London, England. 60 pp.
- Harrington, W. 1908. Fauna Ottawaensis. Hymenoptera-Superfamily III-Vespoidea. The Ottawa Naturalist 22: 69-78.
- Mallet, J. and K. Willmott. 2003. Taxonomy: renaissance or Tower of Babel. *Trends in Ecology and Evolution*. 18 2: 57-59
- Marshall, S. M. 1996. *Polystoechotes punctatus*- an extirpated giant. *Ontario Insects* 1 3: 45.
- Provancher, L. 1889. Additions et corrections au volume II de la faune entomologique du Canada, traitent des Hyménoptères. Québec. 475 pp.
- Semple, J., G. Ringlus and J. Zhang. 1999. The Goldenrods of Ontario: *Solidago* L. and *Euthamia* Nutt. 3rd Edition. University of Waterloo Biology Series. 39. 90 pp.
- Shaw, M. and M. Hochberg. 2001. The neglect of parasitic Hymenoptera in insect conservation strategies: the British fauna as a prime example. *Journal of Insect Conservation* 5: 253-263.

- Sikes, D. S. and C. J. Raithel, 2002. A review of hypotheses of decline of the endangered American burying beetle (Silphidae: *Nicrophorus americanus* Olivier). *Journal of Insect Conservation* 6: 103-113.
- Skevington, J., D. Caloren, K. Stead, K. Zufelt, and J. Connop, 2001. *Insects of North Lambton*. Lambton Wildlife Inc., Sarnia, Ontario, 181 pp.
- Sugar, A., A. Finnamore, H. Goulet, J. Cumming, J. Kerr, M. Giusti, and L. Packer, 1998. A preliminary survey of symphytan and aculeate Hymenoptera from oak savannahs in southern Ontario. *Proceedings of the Entomological Society of Ontario* 129: 9-18.
- Townes, H. 1957. Nearctic wasps of the subfamilies Pepsinae and Ceropalinae. *Bulletin of the United States National Museum* 209: 1-272.

**THE GIANT RESIN BEE, *MEGACHILE SCULPTURALIS* SMITH, AND OTHER
NEWLY INTRODUCED AND NEWLY RECORDED NATIVE MEGACHILIDAE AND
ANDRENIDAE (APOIDEA) FROM ONTARIO.**

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Recent collecting in restricted tallgrass and oak savannah habitats in Ontario has shown the bee fauna of these sites to be highly speciose. While several surveys have previously documented the Apoidea from a few southern Ontario sites (MacKay and Knerer 1979; Sugar et al. 1998), and have revealed several unrecorded and rare species in Ontario, many Carolinian sites remain to be sampled, and potentially contain additional rare or previously unrecorded species. Current survey work by personnel associated with the University of Guelph Insect Collection in several grassland sites in southern Ontario has led to the discovery of several species new to Canada and Ontario.

As in many other groups of insects the Ontario bee fauna is undergoing changes because of the arrival of foreign species accidentally introduced to North America. One of these new arrivals is *Anthidium manicatum* (L.), which was recently recorded for the first time from Ontario (Smith 1991). This species is now well established in southern Ontario and locally common.

This paper adds one more invasive species of Megachilidae to Ontario and reports new Canadian and Ontario records for three species of Megachilidae and Andrenidae.

New Apoidea Records

All specimens were identified using Mitchell (1960, 1962) unless otherwise stated. Depository is the University of Guelph Insect Collection.

Megachilidae

***Megachile (Callomegachile) sculpturalis* Smith, 1853**

Essex County: 2♂♂, Ojibway Prairie Provincial Nature Reserve, 42°15'N 83°4'W, 30 July 2002, visiting flowers of *Veronicastrum virginicum* (Linnaeus), M. Buck; Point Pelee National Park, West Beach, 1♀ visiting flowers of *Melilotus alba* Medikus (no pollen present in scopa), 29 July 2003, 1♂, 13 August 2003, D. Cheung; **Halton Region**, 1♀, Nassagaweya Township, Twinbrooks Tract, 20 July 2002, W.J. Crins.

Megachile sculpturalis is an eastern Palaearctic and Oriental species that has been introduced to the eastern Nearctic region. This large bee, commonly referred to as the giant resin bee, is easily distinguished from native megachilids by its relatively large size (~17-23 mm) and its infuscated wings. Michener (2000) gives additional characters to separate other Nearctic megachilids from *M. sculpturalis* (the only Nearctic species in the subgenus *Callomegachile*). The specimens from Ojibway Prairie are the first ones collected from Canada. However, shortly before this paper went to print, Mangum and Sumner (2003) published the first observation of this species from Ontario. Their sighting of a single female (apparently no voucher was collected) dates about one week later (8 August 2002), from an unspecified locality in "southern Ontario" (l.c., p. 659). The first Nearctic records of *M. sculpturalis* were from North Carolina in 1994 (Mangum and Brooks 1997). Since then, the species has been recorded from 14 additional states in the eastern U.S.: Alabama, Connecticut, Delaware, District of Columbia, Georgia, Maryland, New Jersey, New York, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, West Virginia (Batra 1998; Kondo et al. 2000;

Ascher 2001; Mangum and Sumner 2003). Females of the subgenus *Callomegachile* line their nests with mud, or more commonly tree resin (Batra 1998), unlike the native leaf-cutting *Megachile*, which line their cells with pieces of vegetation that have been clipped by the female. *Megachile sculpturalis* uses previously existing cavities to nest in, and commonly occupies abandoned *Xylocopa* nests (Mangum and Brooks 1997; Ascher 2001). Mangum and Brooks (1997) recorded *M. sculpturalis* from June to August. The species is polylectic (Mangum and Brooks 1997; Ascher 2001) and visits mainly flowers of introduced species in North America (Mangum and Sumner 2003). The above record from *Veronicastrum virginicum* (L.) represents a new flower record for the species.

***Stelis costalis* Cresson, 1872**

Essex County: Point Pelee National Park, 1♂, 18 July 1978, D.H. Pengelly; 1♀, 20 July 1978, L. Templin; 3♂♂, Point Pelee National Park, *Opuntia* field, 0.75 km N of Visitor Centre, 24 July 2003, S.M. Paiero; 2♂♂, Point Pelee National Park, Old Maintenance Yard, 41°56'54"N 82°31'14"W, 29 July 2003, M. Buck; 1♂ 1♀, Point Pelee National Park, West Beach, 41°59'0"N 82°27'30"W, 13 August 2003, M. Buck; 1♂ 1♂, Point Pelee National Park, The Tip parking lot, 41°55'3"N 82°30'37"W, 13 August 2003, M. Buck; 1♀, Windsor, Ojibway Prairie Provincial Nature Reserve, 42°15'N 83°4'W, 12 September 2002, M. Buck.

This is the seventh species of *Stelis* known from Ontario. It has previously been recorded from Virginia west to Kentucky and south into Florida and Texas (Hurd 1979). Members of this genus are cleptoparasitic on bees of the tribe Megachilini (Hurd 1979). This species is polylectic and the flight period is from March to September (Mitchell 1962).

Andrenidae

***Perdita (Cockerellia) bequaerti bequaerti* Viereck, 1917**

Essex County: 2♀♀, Windsor, Springarden Rd. Area of Natural and Scientific Interest, 42°15'N 83°4'W, 27 August 2002, S.M. Paiero.

The genus *Perdita* is one of the most speciose genera of bees in North America, containing well over 250 species (Hurd 1979). The centre of its diversity is the southern Nearctic, with only three species previously recorded from Ontario. *Perdita bequaerti bequaerti* is the only representative of the subgenus *Cockerellia* in Ontario. It has been previously recorded from New Jersey west to Minnesota and south to Florida and Mississippi (Hurd 1979). The species is distinguished from other Ontario species in possessing broad transverse ivory bands on the abdominal tergites. This species is polylectic and the flight period is from June to September (Mitchell 1960).

***Perdita (Perdita) maculigera maculipennis* Graenicher, 1910**

Brant County: Brantford Railway Prairie, 43°10'N 80°19'W, 1♂, 6 June 2002, white pans, M. Buck; 3♀♀, 24 July 2002, M. Buck & S.M. Paiero. **Bruce County:** Inverhuron Provincial Park, front dunes, 44°17'33"N 81°35'28", 2♀♀, white pans, 1♂, yellow pans, 2 July 2003, M. Buck. **Kent County:** Rondeau Provincial Park, South Point Trail East, 42°15'35"N 81°50'53"W, savanna, 16-17 June 2003, 8♂♂ 12♀♀, white pans, 3♂♂ 25♀♀, yellow pans, M. Buck and H. Carscadden; 1♀, Rondeau Provincial Park, South Point Trail, east parking lot, 42°15'42"N 81°50'49"W, dunes, 16-17 June 2003, yellow pans, S.M. Paiero; **Manitoulin District:** 15♀♀, Manitoulin Island, Providence Bay, 45°39'41"N 82°15'40"W, dunes, 18 July 2003, M. Buck.

This is the fifth species of *Perdita* to be recorded from Ontario. It has been previously recorded from Minnesota, Wisconsin, Michigan, Illinois, Iowa, Kansas and Texas (Hurd 1979). Its natural history was well documented by Michener and Ordway (1963), who indicate that this species

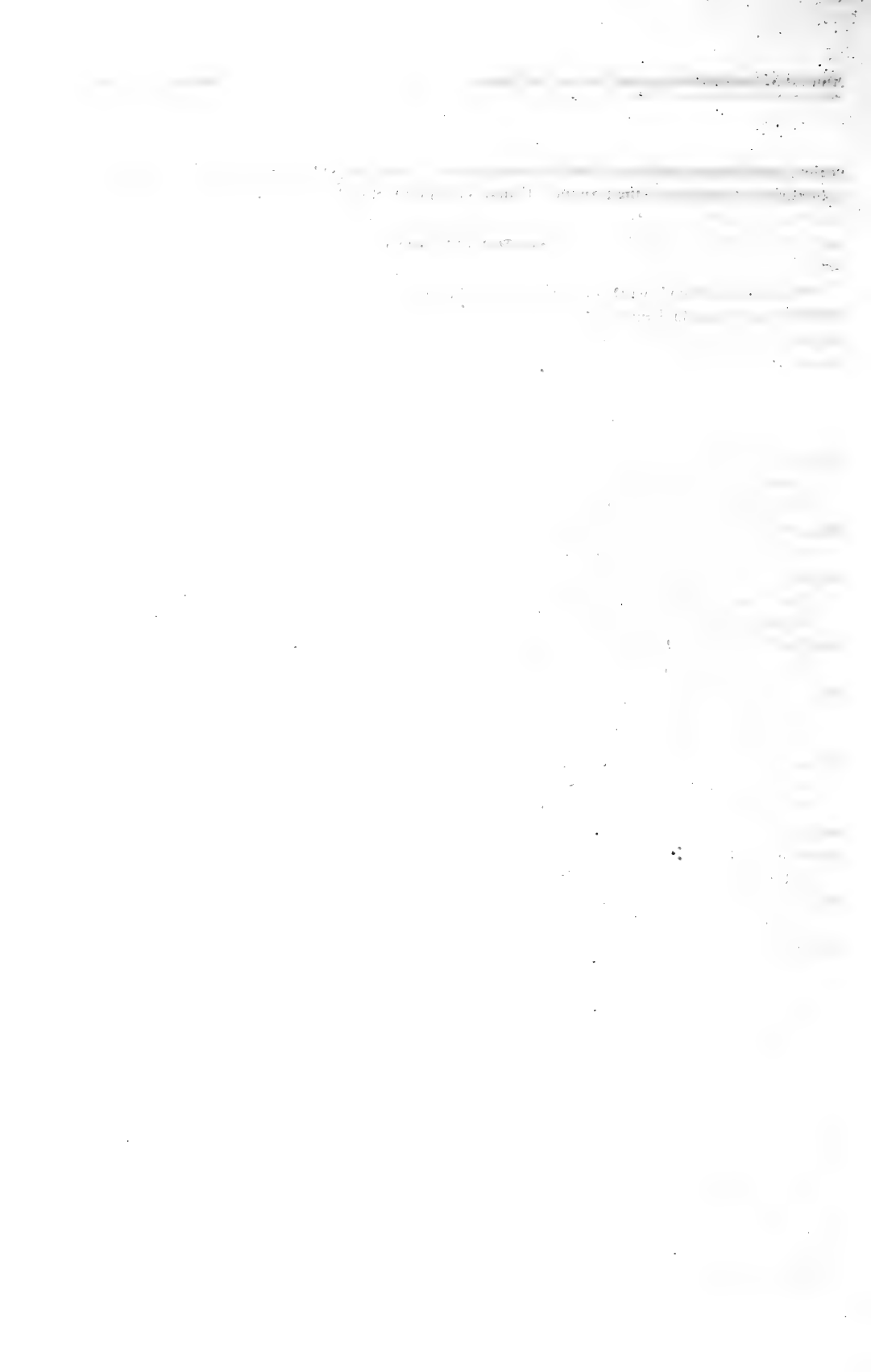
prefers sandy banks. Mitchell (1960) records the adult flight period from June to July. The species is obviously univoltine in the province. Females are polylectic (Michener and Ordway 1963).

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References

- Ascher, J.S. 2001. *Hylaeus hyalinatus* Smith, a European bee new to North America with notes on other adventive bees (Hymenoptera: Apoidea). Proceedings of the Entomological Society of Washington, 103: 184-190.
- Batra, S.E.T. 1998. Biology of the giant resin bee, *Megachile sculpturalis* Smith, a conspicuous new immigrant in Maryland. Maryland Naturalist, 42: 1-3.
- Kondo, T., M.L. Williams and R. Minckley. 2000. Giant Resin Bees! Exotic bee species makes its way from East Coast to Alabama. Alabama Agricultural Experiment Station Highlights of Agricultural Research, 47(3): 4-5.
- MacKay, P.A. and G. Knerer. 1979. Seasonal occurrence and abundance in a community of wild bees from an old field habitat in southern Ontario, Canada. Canadian Entomologist, 111: 367-376.
- Mangum, W.A. and R.W. Brooks. 1997. First records of *Megachile (Callomegachile) sculpturalis* Smith (Hymenoptera: Megachilidae) in the continental United States. Journal of the Kansas Entomological Society, 70: 140-142.
- Mangum, W.A. and S. Sumner. 2003. A survey of the North American range of *Megachile (Callomegachile) sculpturalis*, an adventive species in North America. Journal of the Kansas Entomological Society, 76: 658-662.
- Michener, C.D. 2000. The Bees of the World. Johns Hopkins University Press. 913 pp.
- Michener, C.D. and E. Ordway. 1963. The life history of *Perdita maculigera maculipennis* (Hymenoptera: Andrenidae). Journal of the Kansas Entomological Society, 36: 34-45.
- Mitchell, T.B. 1960. Bees of the Eastern United States: Vol. 1. North Carolina Agriculture Experimental Station Technical Bulletin, 141: 538 pp.
- Smith, I.P. 1991. *Anthidium manicatum* (Hymenoptera: Megachilidae), an interesting new Canadian record. Proceedings of the Entomological Society of Ontario, 122: 105-108.
- Sugar, A., A. Finnamore, H. Goulet, J. Cumming, J.T. Kerr, M. DeGiusti and L. Packer. 1998. A preliminary survey of symphytan and aculeate Hymenoptera from oak savannahs in southern Ontario. Proceedings of the Entomological Society of Ontario, 129: 9-18.



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